INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Vol. 24
No. 1

PUBLISHED MONTHLY BY THE BRUCE PUBLISHING COMPANY, 524-544 NORTH MILWAUKEE STREET, MILWAUKEE, WISCONSIN.
Eastern Office: 40 E. 34th St., New York, N. Y. — Western Office: 66 E. South Water St., Chicago, Ill.

CONTENTS

Guidance in the Evening School, *by Norman L. Rose* 1
School-Shop Foremen's Clubs, *by Ward W. Swain and R. Randolph Karch* 3
Watch and Clock Repairing, *by Samuel Bernard* 4
Principles of Design — V, *by Franklin H. Gottshall* 6
Common Woodworking Tools — IV, *by E. M. Wyatt* 8
Indian Art in Woodwork Design, *by William W. Wills* 10
Collecting With a Purpose, *by Max Chambers* 12
Editorials 13

Informal Tests

Trade Test on Storage Batteries, *by J. W. Fleming and Walter B. Jones* 14
Mechanical-Drawing Test for Second-Year Students in High Schools, *by Hugh Norris* 16
Tests for Hand Fiber Weaving, *by Emil Gandre* 17

Supplements

Wrought-Iron Curtain Rod and Hooks, *by H. M. Andersen* ..... No. 303
Desk and Chair, *by Louis B. Warren* ..... No. 304

Problems and Projects

Wrought-Iron Curtain Rod and Hooks, *by H. M. Andersen* 20
Lubrication Record Card, *by Fred C. Finsterbach* 20
Bending Fixture for Hack-Saw Frame, *by H. M. Andersen* 21
Pages from a Museum Sketchbook (Queen Anne Teapot), *by Burl N. Osburn* 22
Spotty, The Pup, *by D. C. Marshall* 23
Wall Sconce, A, *by Gerald A. Boate* 24
Cutter-Grinding Fixture, A, *by Henry P. Boettcher* 26
Sewing Cabinet, *by Floyd D. King* 26
Model Yacht Regattas, *by Claude William Horst* 27
Drop Forging, *by G. H. Snaddon* 28

Some Questions Answered 31
Associations, Conventions 32
Personal News 6A
School Shop Equipment News .. 7A

ADVANCE NOTICE

The February issue of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION will again be designated the School Shop Annual Number.

This will be the eighth edition of this comprehensive and helpful Annual. Like its predecessors, its aim will be to present the reader with an overview of the significance of the school shop in education, of the newer trends in school-shop management, of outlines of shop courses that are functioning, of related work that teachers have found helpful, and of efforts made to extend the school shop's influence into the leisure activities of the community.

Besides this helpful material, there will be shop layouts, equipment and materials lists, and a directory of manufacturers, which will be found valuable by everyone engaged in industrial-arts work.

TO OUR READERS

"A Happy New Year" may voice our wish in a trite way. Nevertheless that is what The Bruce Publishing Company wishes to all the readers of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

THIS MONTH'S COVER

The picture used for our cover this month shows the lumbermen engaged in unloading logs from a train at the El Dorado Lumber Company's plant at Pinogrande, California. Photograph, courtesy of U. S. Forest Service.

Articles Indexed—The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."

Entered Jan. 2, 1914, as second-class mail matter at Milwaukee, Wis., under Act of March 3, 1879. Copyright, 1935, by Bruce Publishing Co. Title registered as Trade Mark in U. S. Patent Office, Nov. 25, 1930.

Subscription Information—Subscription price, $2.50 per year, payable in advance. Canadian postage and tariff, $1.00, foreign countries, 50 cents. Copies not over three months old, 25 cents; more than three months, 50 cents. Notice for discontinuance of subscription must reach Publication Office in Milwaukee, at least fifteen days before date of expiration. Changes of address should invariably include old as well as new address. Complaint of nonreceipt of subscribers' copies cannot be honored unless made within fifteen days after date of issue.

Editorial Contributions—The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

The Magazine is on sale at Brentano's, New York; Wanamaker's, Philadelphia; Brentano's, Chicago; Philippine Education Co., Manila, P. I.

A COMPLETE LINE

- Correlated!

Variable Speed Lathe
Scroll Band Saw
Tilting Arbor Saw
Hand Jointer
Hollow Chisel Mortiser
Surfacer
Shaper
Spindle Sander
Disc & Belt Sander
Roll-Feed Drum Sander

ALL Yates-American "J" Line machines for Vocational Training are definitely related to one another in size and capacity, and to the unit needs of Vocational Departments. With our complete line you are thus assured of correct design, appropriate size, rugged endurance, complete safety, balanced capacities and unified responsibility in all your woodworking equipment.

YATES-AMERICAN

YATES-AMERICAN MACHINE COMPANY
BELOIT, WISCONSIN

Only '94 Complete
with Reversing Motor Drive

for the New 9" SOUTH BEND Back-Geared, Screw Cutting "WORKSHOP" Lathe

Operates from Lamp Socket for 2c per hour

Wt. 300 lbs.

A Metal Working Lathe

9" x 3' "Workshop" Bench Lathe complete with reversing motor, reversing switch and motor drive unit, as shown... $94

Over 35 Modern Features

The new 9" x 3' "Workshop" Lathe is designed and used for small general machine work in repair shops, laboratories, machine shops, auto service shops, electrical shops, and industrial plants. More than 35 modern features include: back-geared headstock with 6 spindle speeds; automatic power feed to carriage as fine as 350 per inch; graduated compound rest; micrometer collars on compound rest and cross feed screws; reverse for left-hand feeds and screw threads. Price without motor drive, $75. Other bed lengths, 3½' and 4'. Can be installed singly or in groups. Easy Payment Terms can be arranged to suit the budget of any school district. Write for new 32-page descriptive Bulletin No. 5-B.

Other Sizes and Types

South Bend Back-Geared, Screw Cutting Precision Lathes are built in 96 other sizes and types, 9" to 36" swing, countershaft and motor drive, $75 to $1500. General Catalog No.94 free on request.

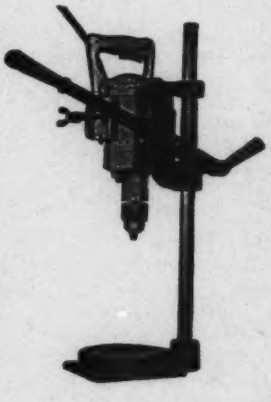
New revised 31st Edition of "How to Run a Lathe," 160 pages, 400 illustrations, just off the press and ready for distribution. 25 cents per copy, sample copy free to any instructor.

NRA **South Bend Lathe Works**

136 East Madison Street South Bend, Indiana, U. S. A.

Lathe Builders Since 1906—Users in 97 Countries

CLARK



"Clark" drills and accessories have been familiar objects in school shops for years. They are outstanding examples of skill and workmanship and they have proven to be a lasting investment for the user.

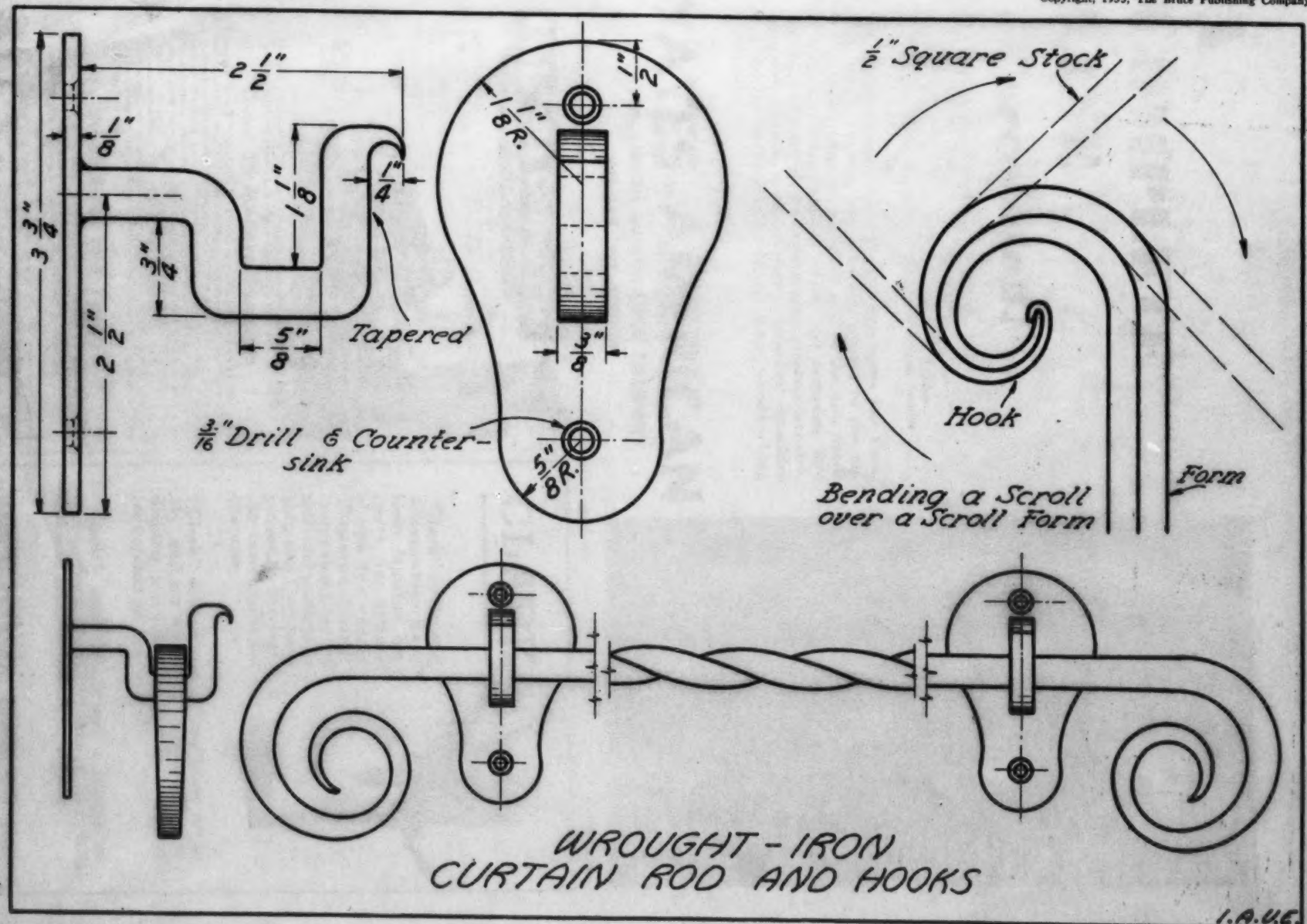
"Clark" drills range in size from $\frac{3}{16}$" to $1\frac{1}{2}$" and are suitable to practically any drilling job. Special speeds and gear reductions on application.

"Clark" drill stands are a means of converting a hand drill into an inexpensive and efficient bench drill press.

JAS. CLARK JR. ELEC. CO. Inc.

600-640 Bergman St. LOUISVILLE, KY.

To be Reproduced for School-Shop Use Only
Copyright, 1935, The Bruce Publishing Company



Designed by H. M. Andersen, Cicero, Illinois

(This article is continued on page 20)

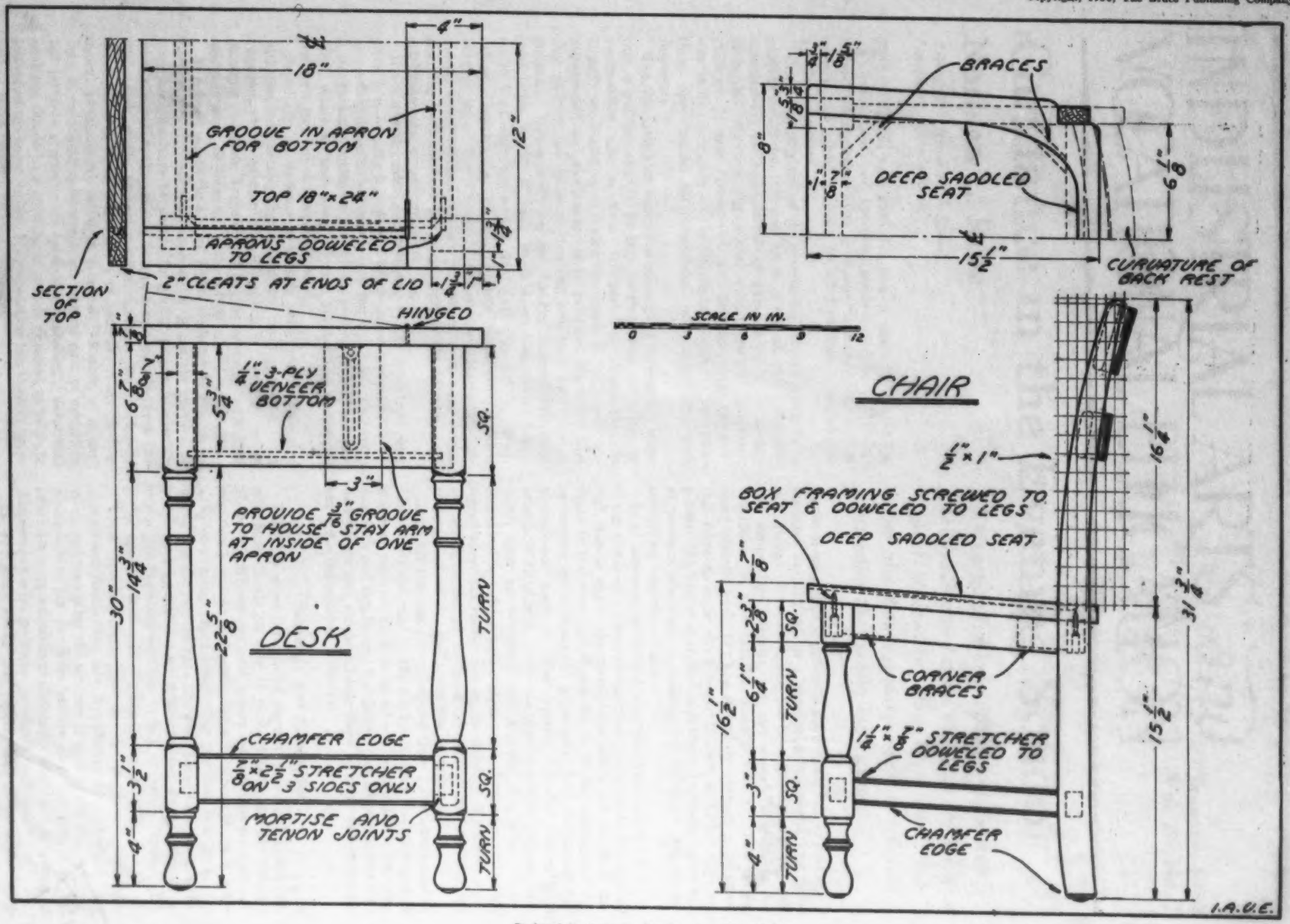
To be Reproduced for School-Shop Use Only

Designed by H. M. Andersen, Cicero, Illinois

(This article is continued on page 20)

TRACING SUPPLEMENT, No. 304, January, 1935
INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

To be Reproduced for School-Shop Use Only
Copyright, 1935, The Bruce Publishing Company



Designed by Louis B. Warren, Rye, New York

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

January, 1935
Vol. 24, No. 1

Guidance in the Evening School

Norman L. Rose

Herron Hill Junior High School,
Pittsburgh, Pennsylvania

This article is a brief abstract of a master's thesis submitted at the University of Michigan. It is based on a study of the vocational- and educational-guidance needs of students attending the evening high school.

THERE has been a decided lack of study relating to the educational- and vocational-guidance needs of evening-high-school students. Even programs of organization of an evening high school have not included vocational guidance as a definite function.

One major objective of the evening high school should be to provide instruction that will result in the selection of a suitable lifework and some definite preparation for it. To accomplish this objective, the school should provide systematic guidance. It must "consciously and definitely make preparation in its curriculum for the intelligent choice of the educational opportunities for occupational adjustments and readjustments."[1]

The importance of vocational guidance is no longer a question in our day schools, be they junior, senior, part-time, or continuation schools. Even "industrialists throughout the country are beginning to realize that much of the present unemployment and many other social evils are due to the fact that persons now at work stumbled into their jobs without guidance," remarked Miss Cooley,[2] at the National Education Association meeting in 1931. Prof. Meyer Bloomfield,[3] Director of Vocational Guidance at New York City College, speaking at a luncheon of the City College Vocational Guidance Society, stated that the shock of business failures had convinced industrial leaders that the misuse of human energy resulting from improper guidance would eventually close their establishments, unless corrected.

If vocational guidance is deserving of the important place given it in our day schools and by the more progressive business establishments, how much more important is it that vocational guidance become a part of our evening-high-school program, where we find many who are vocationally unadjusted seeking a way out of their difficulties!

Practically all students in evening schools are confronted with problems of choosing a vocation, or of preparing for a vocation, or of earning advancement in a vocation, or of changing vocations. Therefore, as Leavitt believes, "vocational guidance must be inherent in the whole school system."[4]

As pointed out in the United States Bulletin[5] on *Vocational Guidance in Secondary Education*, "it is not the purpose of vocational guidance to decide for young people in advance what occupation they should follow, nor to project them into life's work at the earliest possible moment, nor to classify them prematurely by any system of analysis, either psychological, physiological, social, or economic." Rather, as Myers[6] puts it, vocational guidance is an integral part of education but involves a number of specialized activities. "Vocational guidance should be a continuous process designed to help the individual to choose, to plan his preparation for, to enter upon, and to make progress in an occupation."[7]

In accordance with this conception of vocational guidance, the evening-school student not only should be guided in his choice of subjects, the problems confronting him in choosing a vocation, preparation for a vocation, advancement in a vocation, change of vocation, and the development of avocational and leisure-time interests, but also should be given needed assistance "in such practical situations as (1) how to get along with the boss; (2) how to find the answers to questions that come up in the day's work; (3) how to budget their expenses; (4) how to overcome handicaps of personality or lack of previous education or training," as Stoddard[8] and his investigating committee agree.

In an endeavor to find out what provisions should be made in the set-up of a vocational-guidance program in the evening high schools and in the curriculums which will aid their students to make an "intelligent choice of the educational opportunities for occupational adjustments and readjustments," a study was made of three different types of evening high schools in Pittsburgh, Pa. — the general evening high schools which offer an evening-school diploma, but which is not equivalent to a day-school diploma; the standard evening high school where the courses are on the standard day-school level, and which credits are accepted for college entrance; and the trade school which gives no credits or diploma.

Data for the study were secured from 1,186 questionnaires filled in by the men in these schools. Only the problems in guidance, common to all three schools, were studied. From the summary and conclusions it is hoped that administrators may find suggestions which will help them to solve this important but neglected phase of education.

Summary and Conclusion

I. Eighty-seven per cent of the men who enroll in the evening high schools are over 18 years of age; 31.8 per cent are above 25. Ninety per cent enroll for self-improvement and vocational reasons. Six years elapse between the median age (16) of evening-school students at the time they leave day school and the median age (22) when these same students enroll in evening high school. Approximately 49 per cent of the day-school drop-outs were due to lack of interest, lack of ability or opportunities, and disciplinary troubles.

These figures indicate that the evening high school must interest not youths, but men, by offering subjects which they want, and presenting the subjects in such a way that not only young adults but the more mature men will look upon the educational opportunities as something which can help them to discover and solve problems peculiarly their own.

II. The study shows that evening-high-school students are not aware of the opportunities which are theirs for the asking. As a result there is a great deal of maladjustment.

When students enroll in the evening high school, they do not have satisfactory counseling in the choice of courses or subjects. Practically no attention is given to vocational counseling. For these reasons, after being enrolled, students request subjects which are taught in schools other than the one they are attending. For example, students in the trade school ask for commercial subjects; others request subjects which are taught in their own school.

Students who were not graduated from elementary or high school enroll for courses different from the ones they were pursuing in day school. The highest percentage of change is from the commercial and vocational courses into the academic. The next highest percentage is from the academic and vocational courses into the commercial. However, students who were following a general high-school course, or those who never went beyond the elementary grades, elect the vocational course in preference to the academic or commercial.

If twenty or more students in a school make request for a subject which is not in the curriculum of that school, such a class will be organized. A criticism of this arrangement is that while the opportunity exists for students to take subjects they want by asking for them, many registrants are not informed how and where to make their desires known. One way to aid these men is to give greater publicity to the subjects which are offered in the various schools *before* registration, and to provide greater publicity *before registration* of the opportunity to have classes organized when twenty or more request the same subject.

Counselors should note from the statements which students themselves made that day-school courses and extracurricular activities have not served as guides to occupations as might have been expected. However, the abilities of students should be given much consideration. According to the students' own statements, abilities they believe they possess for the occupations which they would like to follow have a strong determining influence in the selection of evening-school subjects. The counselor, therefore, should make capital of this.

It is recommended, therefore, that in order to reduce maladjustments to the smallest minimum, no student should be registered until he has had a conference with a person who is qualified to counsel regarding his desires — both educational and vocational.

III. In order to provide opportunity for personal conferences and avoid possible maladjustments at least as to courses, teachers should assist during registration week. Since "the most common medium for vocational guidance is the classroom teacher," according to the finding of Helen M. Simmen[9] in her study of graduates of high school, teachers should be employed to teach in the evening high schools who are prepared by *training* and *experience* to counsel.

Personal conferences conducted during enrollment should be followed up during the year.

A general study should be made early in each semester in each school to find the maladjusted cases, and to make proper adjustments, so that no student will lose valuable time in his preparation for a vocation. This would necessitate having a trained vocational counselor (who might be a vice-principal) in each evening school, whose various duties would also include arranging for assembly talks by experienced men.

IV. Important findings in this study which should be of value to vocational-guidance counselors are enumerated below:

1. Less than one fourth (22.3 per cent) of the students lost their jobs either directly or indirectly due to the depression.

2. Young workers take their first jobs because they are the only ones available. Although they change from job to job, trial and error helps men to measure themselves with the job in interest, ability to work, opportunities for getting established, and earning capacity. A liking for the kind of work has twice as much to do with the choice of a job as the wages expected.

3. As the workers change jobs, they depend less upon personal application by walking in and applying, or upon relatives, but more upon placement offices, advertisements, and friends who are willing to recommend them.

4. Nearly 59 per cent of the workers remained two years or less in any job. Practically one fourth (24.1 per cent) remained less than one year. The median time for remaining in the first and second jobs was one and one-half years; in the third job, two years.

5. Workers do not become permanently adjusted early in their working careers. This adjustment comes at 25 years of age or thereabouts — a period when home responsibilities are pressing.

There is, therefore, a great need for the adjustment of adults, through the educational services which the evening school can provide.

V. The present set-up in our evening high schools does not lend itself to occupational study, assembly talks, or individual conferences either before registration or during the school year. The importance of making provision for these needs is emphasized by the following facts which were obtained from this study:

1. Twenty-five per cent of the students are not taking courses which will lead to occupations they hope to hold eventually. This figure includes only those who state they are studying and preparing for a definite occupation.

2. Nearly 12 per cent indicate in no way that they have any idea what occupation they would like to follow.

3. Seventy-two per cent beyond the age of 19 never made any kind of occupational study in school; 71.4 per cent had no group occupational information; and 71.8 per cent never had a teacher or counselor talk with them personally about a choice of occupation.

4. About 86 per cent (85.6) request assembly talks by experienced and successful men about 182 different occupations, many of which, such as professions, are very inclusive; 64.6 per cent would welcome personal conferences about occupational information and problems; 19 per cent of whom designate a particular person with whom they would like to talk.

VI. Since the business and industrial world is not organized for guidance purposes, it devolves directly upon the evening school to prepare for this service, and to provide in a workable, practical manner an opportunity for occupational information and vocational guidance for evening-high-school students. Its service to the public involves these responsibilities.

This can be accomplished by a program of occupational studies effected through the English and social-science departments as well as in the various trade courses, individual counseling, and assembly talks.

Provision also should be made to put into effect the recommendations of Dr. Stoddard's committee,[10] namely: to provide for classes in practical situations as, (1) how to get along with the boss, (2) how to find the answers to questions that come up in the day's work, (3) how to budget expenses, (4) how to overcome handicaps of personality or lack of previous education or training.

VII. These reports, by the men students of the public evening high school, are essentially a challenge to those in charge. Their faith in the power of the public schools is involved in their expression of its ability to meet their needs. The challenge can be met and faith strengthened if the evening high schools will put into practice a principle emphasized by Frank M. Leavitt, a leader in the vocational-guidance movement, that "vocational guidance must be inherent in the whole school system."[11]

Bibliography

[1]John H. Saul, "In the Evening High School," *Vocational Guidance*, V (February, 1927), 221.

[9]Emma Pritchard Cooley, *Counseling and Guidance*, National Education Association, Addresses and Proceedings, 1931, 69, p. 679.

[10]*New York Times*, March 13, 1932, Section I, p. 26, col. 8.

[4]Frank M. Leavitt, *Vocational Guidance—Its Spiritual Principles,* Industrial Education XXVII (December, 1925), 171.
[5]*Vocational Guidance in Secondary Education,* Bulletin 1918, No. 19 (Washington: U. S. Bureau of Education), p. 9.
[6]George E. Myers, *The Problem of Vocational Guidance* (New York: Macmillan Company, 1929), pp. v, 311.
[7]*Vocational Guidance in Secondary Education,* Bulletin 1918, No. 19 (Washington: U. S. Bureau of Education), p. 9.
[8]A. J. Stoddard and others, "Functions and Organizations of Guidance in Public Evening Schools," *Vocational Guidance,* VIII (February, 1930), pp. 195–6.
[9]Master's Thesis, *A Study of the Graduates of the Fifth Avenue High School, Pittsburgh, Pennsylvania,* University of Pittsburgh, 1921.
[10]*Op. cit.*
[11]*Loc. cit.*

School-Shop Foremen's Clubs

Ward W. Swain

Herron Hill Junior High School, Pittsburgh, Pennsylvania

R. Randolph Karch

Arsenal Junior High School, Pittsburgh, Pennsylvania

Two versions of the same teaching device, showing how to put it into actual practice and what it accomplishes in the classroom.

ITS ORGANIZATION AND ADMINISTRATION

ONE of the results of the policy of most school boards to cut expenses to the bone has been an increase in pupil load. What should the shop teacher do about this? Should he continue with the methods of teaching he used with smaller classes, or should he devise new ways of handling this increase in pupils?

One way out of this dilemma is the organization of a foremen's club. This will serve a twofold purpose:

First, such a club tends to give character training. Then, too, through it leadership may be developed. The boys learn to respect authority and to understand the problems that confront the employer and employee in real-life situations. Such a club also tends to make the student ambitious, dependable, honest, and obedient in the eyes of his fellows. Furthermore, it trains him in co-operation, tolerance, perseverance, purposefulness, self-control and self-respect.

Second, it aids the instructor in handling large classes.

Under the set-up at Arsenal Junior High School, some 400 pupils are scheduled for printing. Eighth-grade beginners attend shop for one, two, three, four, or five periods a week, according to the particular schedule. The course is elective, one period every day, for the ninth grade.

The Printing Foremen's Club is made up of 15 ninth graders who have been A pupils in the eighth grade. The group meets once a week at the regular school-club period, and discusses problems arising from difficulties encountered during the week. Foremen attend their regular ninth-grade classes daily as usual. In addition to this, they are scheduled in groups of three to all eighth-grade classes, in which they act as foremen. Opposition may be encountered in some schools to this irregular scheduling, but after the advantages of the club are made known, the principal usually will co-operate with the instructor. The club is organized the first few days of school each semester, while the classes are forming. The members of the club immediately elect a president, vice-president, and secretary-treasurer. The instructor sits as adviser at all meetings.

Some eighth-grade classes, smaller than usual, do not need three foremen. In this case, there is always some production or project at hand for one or two of these foremen to work on. This makes it possible for the shop presses to be running with experienced boys in charge almost every period during the day.

The foremen work under the direction of the instructor, who acts as superintendent, while the eighth-grade pupils work under the direction of the foremen. This relieves the instructor of minor details in handling large classes, and gives him time to go about among the members of the class to study progress or see about some special project in printing that needs his personal attention.

The foremen's club may devise some guide for supervising. This prevents, to a great extent, the letting down on the part of the foreman in his regular daily duties. A guide for printing foremen is as follows:

Guide for Foremen's Supervision

1. Order in the class.
   - *a*) Quiet at all times.
   - *b*) Every pupil working.
   - *c*) Order at the proof press.
   - *d*) Proof taken correctly.
2. Typesetting.
   - *a*) Composing stick held correctly.
   - *b*) Each pupil working at his own type case.
   - *c*) Correct justification (all lines tight).
   - *d*) Correct spacing (according to wall chart).
   - *e*) No broken 4- and 5-em spaces.
   - *f*) No type taken from other type cases.
3. Mark and O.K. proofs.
   - *a*) Mark errors and explain mistakes.
   - *b*) Check revised proof with first proof.
   - *c*) Date O.K.'d proof.
4. Distribution.
   - *a*) A few lines at a time from the hand.
   - *b*) No dumping of type in stick, hand, or quad box, for distribution.
   - *c*) All problems distributed before another lesson is started.
5. Clean-up.
   - *a*) Start to clean up at the warning bell.
   - *b*) No proofs taken or read after warning bell rings.
   - *c*) All type off floor.
   - *d*) No leads and slugs in cases, but all returned to racks.
   - *e*) Lead and slug racks in good condition.
   - *f*) Check composing sticks.
   - *g*) Check problem books.
   - *h*) Check textbooks.
6. Figure pupil progress and grades (at the end of six-week period).
   - *a*) Failure (E), below average (D), average (C), above average (B), superior (A).

HOW IT TRAINS CHARACTER

The foremen's club is a most effective way of instilling desirable character traits in junior-high-school boys. The purpose of this club is to train boys to become spirited leaders who set proper examples for the pupils who come under their supervision. In this manner, not only are the members of the club affected, but they also transmit the wholesome spirit of the organization to the other junior-high-school students.

The printing foremen's club at Herron Hill Junior High School consists of ninth-grade boys who have had printing for at least two semesters. From the membership of the club, certain boys are selected and scheduled to periods during which they supervise a particular class. From the number selected, a head foreman for each class is chosen. Usually the head foreman is an A student. Among his duties are: checking the pupils' absence or tardiness; determining the individual progress, and graphing it on the progress chart; noting behavior, and routine work of this kind. The other foremen, besides helping the head foreman supervise the class, are kept busy with special production work.

On club days, all of the members of the foremen's club meet for a discussion period. At these, special problems affect-

ing the foremen's duties and the various discipline cases which may have arisen during the previous week are studied. Among them, for instance, may arise the question "How can one get Johnny Jones to distribute his type properly instead of dumping it all over the case?" "Why does this group of foremen always have a noisy class?" "How can this noisy group be transformed into a class of busy, quiet workers?" "Why is Fred Moore so far ahead of the others in setting progressive lessons, while Jack Bar is so far behind?" "Why does the instructor always ask Ted Daily to do the job that requires unusual dependability?"

During these discussions, the club members begin to understand what traits are desirable, and what things they are to look for in the boys under their supervision.

While all of these boys in the foremen's club are doing real, worth-while projects in printing, they also are disseminating the idea to the other students that there is a square, manly way to do things, and that other behavior will not be tolerated. Through supervision, these lads make their own rules, and they are proud of them. Given responsibility, they sometimes change from shiftless, unworthy habits, and form new worthy ideals and standards for themselves as well as for the rest of the group.

Take the case of Bill Hammon. Bill was one of those noisy troublemakers, indifferent to his work and a general nuisance. Needless to say, his marks were low, and there were but few teachers who could get along with him. Bill was taken aside one day and told he was needed to fill an important position in the foremen's club. This appealed to Bill, and he accepted. Now, Bill did not change to an angel by any means — but he improved to such an extent that his attitude was remarked about by other teachers. His marks took an upward trend — not A grades — but there was a decided improvement. On a recent Parents' Day, Bill was proudly handing out a greeting card which he had layed out, set up, and printed himself. Without a doubt, Bill's change was due wholly to the important and responsible position in which he was placed, coupled with the atmosphere of our informal discussions during club period.

Bill isn't the only boy the foremen's club has reached and helped in a similar manner. Through a club of this kind, the opportunities for real character training are unlimited. The writer does not wish to convey the impression that this is the only way in which character training is given in his shop, but he finds the printing foremen's club one of the best devices for the training of character.

Watch and Clock Repairing

Samuel Bernard

Central School of Business and Arts, New York City

A description of the need for such a course, the projects that may be embodied in the course, and equipment and tools needed.

NEW YORK CITY has had an adult class in watchmaking for some time. Other state departments and cities offering vocational education, might find the experience in New York City of value to them.

The cost of equipment required for such a course is really very low. Local jewelers, watch- and clock-importing or manufacturing agencies, and jewelers' supply houses, usually will co-operate by making donations that will further reduce the first cost of equipping the department.

Benches for watchwork are usually about 6 in. higher than the standard classroom desk. Boards 18 in. wide put up near windows so as to afford ample light, serve the purpose very nicely. Trays for each student to hold the individual hand tools, may be obtained from watch and jewelry jobbing houses.

For a class of 20 students, these individual hand and bench tools should consist of 20 pairs of watch tweezers, 20 sets of assorted watch screw drivers (they need not have jeweled tops), 20 pin vises, 20 watch brushes, and 20 loops. These instruments would cost between $27 and $28, and a fairly good watchmaking shop for 20 students could be equipped for about $400.

The size of the room would depend very largely upon whether one large bench would be placed along the windows, or whether individual equipment and benches were provided for each student.

The length of time required for the watchmaking course will depend entirely on whether the course is part of the industrial-arts program or a Smith-Hughes trade course.

The work should be of a practical nature, as the students in a watchmaking class may be trained right from the start to do the kind of work that will be required of them when working in a shop. Indeed, they may even earn while learning, making a nominal charge for labor and material on work brought to the school.

In considering watchmaking as a trade or occupation, we naturally must take into careful consideration the physical and mental capabilities of the student. The boy who wants to take up watchmaking has to be naturally patient. He must have the ability to work with small tools. He must be clean and orderly, and possess normal intelligence. He must have

WATCH AND CLOCK REPAIRING		
Divisions	Subdivisions	Operations
POWER	Main wheel Mainspring Winding arbor Winding ratchet Winding-ratchet click Winding-ratchet-click spring Crown wheel	Examine teeth Test elasticity See that it grips See winding is free Have sufficient recoil Have friction enough Mesh well with ratchet
TRAIN	Main wheel Center wheel Third wheel Fourth wheel	Revolve train smoothly Test depthing and sideshake Straighten second-hand carriage Remove pivot burrs
ESCAPEMENT	Escape wheel Pallets Two pallet jewels Lever Balance Hairspring Roller Roller jewel	Polish escape teeth Test lock Test release Shape guard pin Polish staff pivots Poise for flat Poise for round Oscillate to and fro Shellac if loose
WINDING	Stem Crown Winding-pinion clutch	Fit it snugly Recut thread if loose Oil stem Polish off teeth burrs
SETTING	Detent Setting lever Setting-lever spring Yoke Pillar clearage	Have bent end in stem groove Have it in groove of stem wheel Have full meshing See it holds setting firmly Pull stem out; turn; test
HANDWHEELS	Cannon pinion Minute wheel Hour wheel Hand washer	Have it friction-tight Oil third-wheel pivot Free it on cannon pinion Steady position of hour wheel
DIAL	Legs; screws If snap, secure edge	Straighten legs Screw them firmly to pillar
HANDS	Second hand Hour hand Minute hand	Clear dial Clear second hand; minute hand Clear crystal
CASING	Case sleeve Stem fitting Movement-case screws	Secure in case neck Have it set when you pull out Wind when run down
CLEANING and REGULATING		Remove defects Rejuvenate; lubricate Adjust it to keep time

Outline of watch and clock repairing

an aptitude for mechanical work, and must possess, or develop, an extremely fine sense of touch.

The question is frequently asked by the student, "How much can a watchmaker earn?"

The answer to this is that year in and year out, the young man entering this trade and doing good work can probably earn more than he could at many of the other more uncertain, if more highly paid, trades and occupations. The bricklayer, the plumber, and others might make more per hour during boom periods. Seldom, however will they be ahead in the long run. Moreover, as the watchmaker continues his studies and becomes still more highly skilled, his possibilities for greater earnings will rapidly increase. Whether he makes $35 a week, or $100 or more a week depends largely upon himself. Everything hinges on his ability to do work well and then, grasping the merchandising aspect of watchmaking, to "sell" himself to his employer and, more particularly, to the customers for whom he works.

There have been those who objected to watchmaking on the score that it is not a healthful occupation, requiring long hours crouched over a bench working with mechanisms of the smallest sort. The answer to this is that any occupation can be unhealthful if the worker is willing to let it be so. Certainly, watchmaking is not inherently any more dangerous to health than countless trades where workers are exposed to all types of weather, or still others where the degree of confinement is just as great. As in any work, it is up to the worker to guard his health as his most precious asset, and it is no more difficult to do this in watchmaking than in practically any other trade.

Not long ago *The Keystone*, the leading trade (jewelry) publication gave the following answer to the question, "What future is there for the man who takes up watchmaking?"

"One of the oldest of trades, watchmaking still holds real possibilities for those who will make the most of them. It offers the young man a well-paying profession which he can take with him wherever he goes — a profession for which there is a demand in every part of the civilized world. Moreover, it offers a logical entry into the jewelry business — a chance to build, step by step, a store of his own."

Just how many jewelry stores have been founded by watchmakers, just how many have been the outgrowth of ambitious dreams at a watchmaker's bench would be impossible to say. Certain it is that well over half of the jewelers of today are also watchmakers. And certain it is that in times of depression, such as the one through which we are just passing, many have found it possible to return more and more to watchmaking as a means of tiding them over the spell of low merchandise sales. While the watchmaker's bench has been the stepping-stone to countless outstanding successes in the jewelry business, there also are a large number of inventions along other lines which originated in the minds of watchmakers.

While it takes time and patience to become a good watchmaking technician, nevertheless, the elementary units of watchmaking may be taught even to boys in continuation schools so that they can help their employers with some of the less intricate jobs. Students in the vocational or trade schools, evening extension or technical high schools who pursue watchmaking, will find each succeeding lesson a step higher up the ladder, until finally the necessary skill has been acquired to repair every make of watch and clock.

Why Teach Watch Repairing in the Public School

1. There is little opportunity offered by the trade for learning watch repairing.
2. Watch repairing is pleasant, interesting, and fairly remunerative.
3. The work is steady.
4. It requires great skill.
5. The trade probably will never be affected by production methods or by business depressions.
6. Immigration restrictions of skilled Europeans makes the training of American watchmakers practically imperative.

Clock-Repairing Projects

1. Strip and clean 1-day clock
2. Strip and clean 8-day clock
3. Strip and clean 8-day calendar clock
4. Continuous alarm, 1-day
5. Intermittent alarm, 1-day
6. Repair 8-day alarm
7. Overhaul portable desk, 8-day time
8. Overhaul portable desk, 8-day time and alarm
9. Strip and clean hour strike
10. Strip and clean half-hour strike
11. Overhaul and adjust wall regulator
12. Overhaul thoroughly French 8-day strike
13. Thoroughly overhaul cuckoo clock
14. Clean and adjust suspension of 400-day clock
15. Repair quarter chimes

Watchmaking Projects

Filing groundwork

1. Round filing
2. Flat filing
3. Taper filing
4. Square filing

Treatment of metals

1. Hardening steels
2. Tempering steels
3. Coloring steels
4. Finishing steels
5. Cleaning dials

Graded operations

1. Fit crystals
2. Fit mainsprings
3. Make mainspring ends
4. Make click springs
5. Make setting springs
6. Make dial legs
7. Fit hands
8. Fit cannon pinion and independent center pinion

Lathe work is an essential part of watch repairing

1. Prepare cutting tools
2. Turn brass and soft steel
3. Turn tempered steel
4. Make barrel hook
5. Make barrel arbor hook
6. Make cone staff
7. Make clock pinion
8. Dovetail wheel teeth
9. Pivot clock wheels
10. Make clock and watch screws
11. Make stems and fit sleeves and crowns
12. Fit cylinder
13. Pivot cylinders
14. Pivot watch wheels
15. Turn balance staffs
16. Fit pivot bushings
17. Set train jewels in plate
18. Fit center jewels

Escapement precision

1. Set cap jewels
2. Fit regular pins
3. Pin hairspring, collet, and stud
4. Set roller jewels
5. Set jewels to pivots
6. Set balance jewels
7. Adjust endshake, sideshake
8. Straighten hairsprings
9. Shape Breguet overcoil
10. Vibrate hairsprings
11. Fit guard pin
12. Set pallet jewels
13. Transpose balance screws
14. Undercut screw heads
15. True balances in the flat
16. True balances in the round
17. Poise balances, pocket and bracelet

Finishing operations

1. Overhaul American pocket watches
2. Overhaul foreign pocket watches
3. Overhaul foreign wrist and bracelet watches
4. Overhaul American wrist and bracelet watches
5. Overhaul baguette watches
6. Demagnetize watches and tools
7. Thoroughly overhaul English fusee
8. Thoroughly overhaul chronograph
9. Thoroughly overhaul repeater
10. Time watches in six positions

Watch Repairing (Tools Required)

Group No. 1 for Beginners

assortment of watch screw drivers
watch-assembly tweezers
hand-removing tweezers
hairspring tweezers
single loupe
double loupe
watch brush
clock brush
flat pliers
round-nose pliers
cutting pliers
bench vise
filing block
pin vise
oilstone
stoneslip
bench hammer
assortment of small files
assortment of small broaches
adjustable saw frame
saw blades
hole plate
2 hand polishing buffs
watch-movement holders
blowpipe
alcohol lamp
burnisher
caliper for pinions
caliper for balance staffs
squarer graver
soldering tweezers
watch oil cup
clock oil cup
sleeve wrench

Group No. 2

staking tool
wrist-movement holder
dial-movement blower
screw plate
pivot files
screw-head files
tweezer (hairspring adjustment)
jewel burnisher
watch screw drivers
hairspring shaping tweezers
hairspring vibrator
mainspring gauge
broaches, assorted
hairspring collet wrench
hairspring leveler
cylinder punches
watch punches
clock punches
pin pusher
jewel tweezers
straightening pivot tweezers
roller remover
jewel pin setter
small compass
clock level
combination roller and pallet jewel setter
demagnetizer

Special Tools

anvil
balance scale
8-in. brass blowpipe
hand blower
English assorted pivot broaches
2 clock brushes
2 watch brushes
felt hand buff
2 emery buffs
burnisher
caliper
alcohol cup
benzol cup
clock oil cup
agate-watch oil cup
assorted pivot drills (watches)
assorted pivot drills (clocks)
automatic drill
loupe
double-lens loupe
mainspring gauge
assorted gravers
hand remover
set of 6 jewel-bezel cutters
alcohol lamp
bench lathe
movement covers
bracelet movement holder
set of 6 movement rests
pegwood
pendent-bow pliers
English pliers
file, round
file, square
assorted small files
Universal tailstock chuck holder
brass and fiber-face mallet
oiler
saw frame
flat saws
poising tool
assorted screw drivers
star pendent-set sleeve wrench
staking tool
assorted tweezers
pin vises
soldering tweezers
hand tong
degree gauge
pith
prepared brilliantine
Nye's watch and clock oil
English cutting broaches
bench vise
hairspring vibrating tool
compass for testing magnetism
demagnetizer

Principles of Design—V

Franklin H. Gottshall

Scotch Plains, New Jersey

The fifth in the series of articles on the subject of design discusses the application of ornament.

ORNAMENT, AND ITS APPLICATION TO DESIGN

WHEN an object is being designed, certain places will naturally suggest themselves as suitable places to be enriched with ornament. Figure 29 shows a copper dish, ornamented in *repoussé*, a form of ornament in which the design is raised with punches. It is quite obvious that the border rather than the center is the ideal place for ornament on an object of this kind. To put it in the center would interfere with service. On furniture, the natural places for ornament are doors of cabinets, drawer fronts, table aprons, chair backs, chair and table legs, panels, tops of pieces, such as pediments, bedposts, and outlines around important openings. These may be classified into four distinct groups as follows: outlines, borders, panels, and shaped or modeled surfaces.

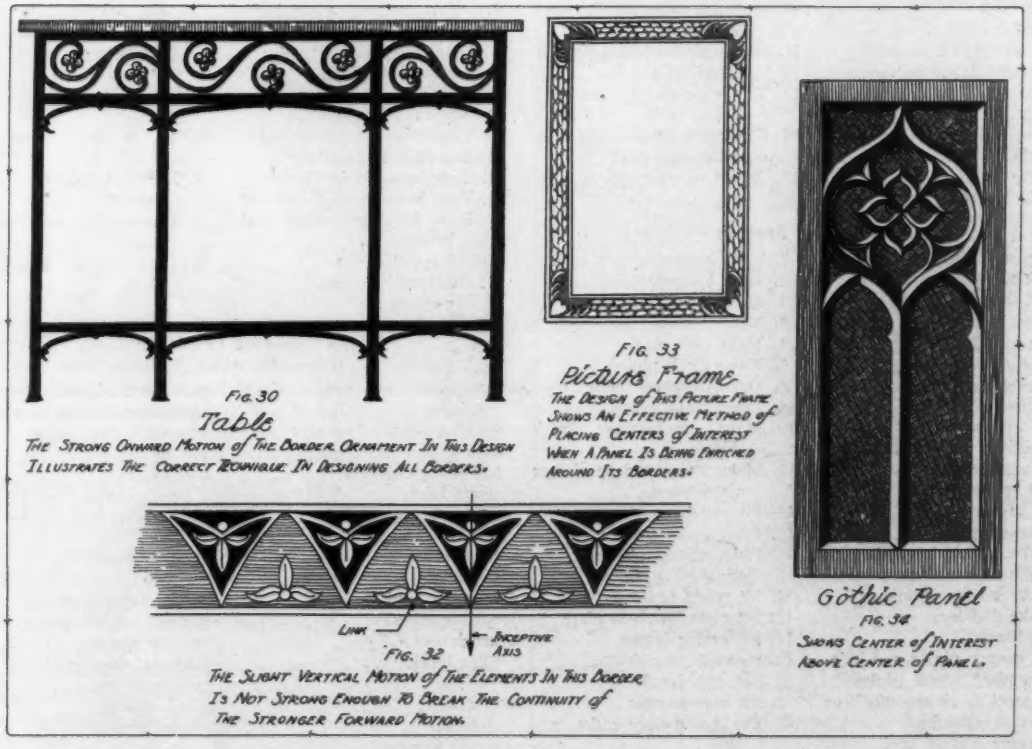


FIG. 30
Table
THE STRONG ONWARD MOTION OF THE BORDER ORNAMENT IN THIS DESIGN ILLUSTRATES THE CORRECT RONHIQUE IN DESIGNING ALL BORDERS.

FIG. 33
Picture Frame
THE DESIGN OF THIS PICTURE FRAME SHOWS AN EFFECTIVE METHOD OF PLACING CENTERS OF INTEREST WHEN A PANEL IS BEING ENRICHED AROUND ITS BORDERS.

FIG. 32
THE SLIGHT VERTICAL MOTION OF THE ELEMENTS IN THIS BORDER IS NOT STRONG ENOUGH TO BREAK THE CONTINUITY OF THE STRONGER FORWARD MOTION.

Gothic Panel
FIG. 34
SHOWS CENTER OF INTEREST ABOVE CENTER OF PANEL.

Enrichment of Outlines. Outline, or contour enrichment, was treated at some length in the second article of the series under, "Curved Lines and Elements, and Their Applications to Outline Enrichment." All ornament falling under this classification is composed of straight or curved lines, and comprises scroll-sawed patterns, turnings, moldings, carving in bold relief, and scrolled metal work, such as was shown on the mirror frame (Fig. 15) of the aforementioned article. Outline enrichment must not destroy logical structure, but must help to support and strengthen it, and unite individual members into a unified whole. The object on the right, in Figure 31, a turned powder stand, illustrates this rule admirably. The outline enrichment is beautifully formed, and designed to support the structure. Note the supporting nature of the element directly under the container, the adequate base, and the excellent proportions.

Enrichment of Borders. Under the general classification of borders will be found members such as table aprons, seat rails of chairs, friezes under cornices of cabinets, rails and stiles on doors, borders enclosing panels and picture frames, on objects made of wood. On objects made of metal or clay, they may be designs following the outline of an object, such as a plate, a pitcher, or a teapot (see Fig. 29). On objects of wood, such as furniture, the borders may be carved, inlaid, or may consist of moldings. On objects of metal, such as copper or silver, they may be cut out, or pierced through the material, enameled in beautiful colors, raised as shown in Figure 29, etc. On objects of clay, such as pottery or china, borders may be painted, modeled, etc. On woven materials or hooked rugs, borders form an important part of the decoration.

Whatever the material, or the manner in which the design is applied to the material, the ornament on borders should be dynamic; that is, it should cause the eye to move in the direction taken by the border itself. Figure 30 shows a table made of iron, the border on the apron of which is an excellent illustration of this rule. None of the elements of the design on the border destroy the movement in this direction by contrary motions of sufficient prominence to break the continuity of the forward movement. This is also true of the border on the plate in Figure 29. There is often a slight contrary motion, on what is known as the inceptive axis, which gives added interest to the design. The inceptive axis is a definite or imaginary line about which design elements are grouped in symmetrical fashion to form a design unit (see Fig. 32). A number of these units may be connected by other elements of minor importance, known as links. These help the eye to bridge what would otherwise be a gap in the design. The foregoing illustrates once more the principle of dominance of one design unit over another, a principle always found in good design.

Inlaid bands are favorite decorative elements, especially on furniture. There must be a harmony of scale and color between them and the parent mass. Too prominent a border, or one on which the figure is too large, should be avoided in most cases.

Enrichment of Panels. Panels are usually minor masses enclosed by borders of some kind. Figure 31 shows two objects on which the ornament is carved to form panels of remarkable beauty. The book end on the left depends for its interest solely upon this form of decoration. There is no outline enrichment to speak of, no border worth mentioning; but the appropriateness of the ornament to the object is quite evident. Panels are found on chests, doors of cabinets, and many other objects; and are generally of the utmost importance in a design, being logical centers of interest. Chair backs, because of their evolution from panels and their great similarity to them, come under the same rules of design as panels, so far as the placing of ornament is concerned. The design of the fern dish, Figure 19 in Article III of this series, entitled "Proportion," shows how the panel method of ornamentation may be adapted to an object made of clay.

If a panel is to be enriched around its border, the ornament should cause the eye to move in the direction of the outline of the panel, and should be of such a nature as to strengthen this outline (see Fig. 29). If this border ornament has important centers of interest, it may be placed at the corners, or at points in the centers of the border, or both. Carved picture frames are excellent subjects to which to apply these principles. The corner is a natural place for ornament, since the eye in following the lines of the design, must come to a temporary stop at that place before it can continue on its journey around the frame. It is for this reason that important ornament is often placed on the legs of chairs or tables where stretchers join these members.

If a panel is to be enriched over its whole surface, the method should be as follows: If the panel is square or round, the center of interest may be in the exact center of the panel. On square panels, centers of interest may be concentrated on lines leading from the center of the panel to the corners. When a panel is rectangular, and is placed in a vertical position, the center of greatest interest may be on the vertical center line, either above or below the horizontal center line of the panel, but preferably above it (see Fig. 34). When a rectangular panel is placed horizontally, interest may be centered at the following places: in its exact center (see box top, Fig. 31), between the center and the ends of the panel on the horizontal center line, slightly above or below the center on the vertical center line. There may be minor centers of interest on all panels, such as shown in Figure 31, but they must not be as prominent as the chief center of interest, and must maintain the balance of the design. The panel on the book end (Fig. 31), is ornamented with a design having what is known as free balance. It is a principle of design slightly more difficult to handle than bisymmetric balance, but if well done it is very effective.

Enrichment of a Modeled Surface. The enrichment of modeled surfaces is more difficult than the enrichment of flat surfaces. To do them properly requires the technique of a sculptor.

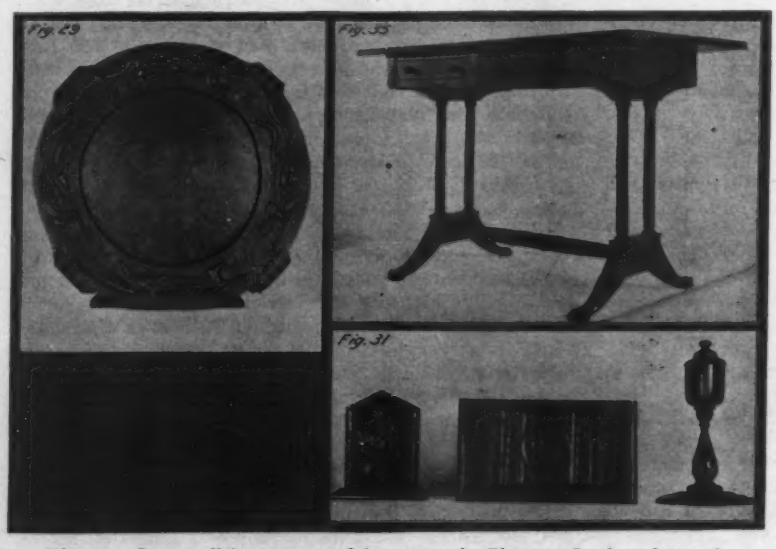


Fig. 29. Copper dish ornamented in repoussé. Fig. 31. Book end, panel, and powder stand. Fig. 35. Table

Modeled surfaces include objects such as cabriole legs, human or animal forms, such as spread eagles, turnings that are to be carved, etc. Because of the varied nature of the outlines and levels on such objects, they require types of ornament that must, in each case, be adapted to the individual structure under consideration. Carving is the most proper medium for enriching a modeled surface. It may be painted or gilded, to be sure, but the basic ornament on an object of this kind, especially if it is made of wood, will be carving. Any ornament carved on a modeled surface must become a definite part of that mass, and if properly executed should give added emphasis and elegance to the structure. Figure 7 shows a table designed in the Duncan Phyfe manner. The ornament on the turned columns has a quiet dignity and refinement that lend elegance and charm to the entire piece. It is in every way appropriate to the design, strengthening it and giving it emphasis. To design ornament for a modeled surface, first draw suitable leading lines. These should be in the form of an inceptive axis, a beautiful curve or curves, or radial lines. The prominent lines and ridges on the acanthus leaf on the powder stand (Fig. 31), are the leading lines in that design. On the feet of the table (Fig. 35), they are also clearly evident. For a more prominent example of this principle, see the beautiful curved and radial leading lines in the design of the carving on the desk (Fig. 26), in Article IV on "The Sources and Kinds of Ornament." The same principle of design is used in planning the ornament for an object like the book end in Figure 31 of this article.

Designs suitable for ornament on modeled surfaces are usually chosen from naturalistic or organic sources. They should be sufficiently conventionalized to make them suitable for the problem in hand. Such ornaments include leaves, flower forms, fruit, seashells, such as the cockleshell, and various other motifs.

Common Woodworking Tools—IV

E. M. Wyatt

West Technical High School, Cleveland, Ohio

The fourth of a series of sketches on the development of woodworking tools.

BORING BITS AND AUGERS

THERE is no more interesting chapter in the story of the evolution of hand tools than that pertaining to man's implements for making holes. This is partly because of the variety of tools man has experimented with for boring, and because the story of such tools spans the entire known history of the human race. No matter how far back we explore into the dawn of man, we find him always possessed with some tool for making holes. There exists today no known tribe of men so low in the scale of intelligence that they do not possess, and make for their own use, tools for boring or drilling holes. This primitive skill includes not only ability to bore holes in soft materials but also in hard stone. Indeed, it is the hard materials like shell, bone, and stone that have survived the many thousands of years between lower savagery and civilization.

Among the oldest known remains of man are broken or flaked stones known to archaeologists as celts, but to most of us rather loosely and unjustifiably exclusively as arrowheads. Among these celts are often found stones similar to the one illustrated in Figure 33. Many pieces of shell, bone, and softer stone have been found that had holes through them made with these crude stone implements. Doubtless these celts were sometimes used, just as they are now found, as awls to twist and dig out holes. It is known, however, that they also were lashed to a shaft in the manner shown in Figure 34, or in bow and strap-driven arrangements. When the white man first found the American Indians, they were using just such drills as this, and many other savage people are still using them. Sometimes they use the end of a hunting arrow just as shown in Figure 34. Sometimes the shaft is revolved with one hand against the thigh so that the other hand can be used to hold the article to be drilled.

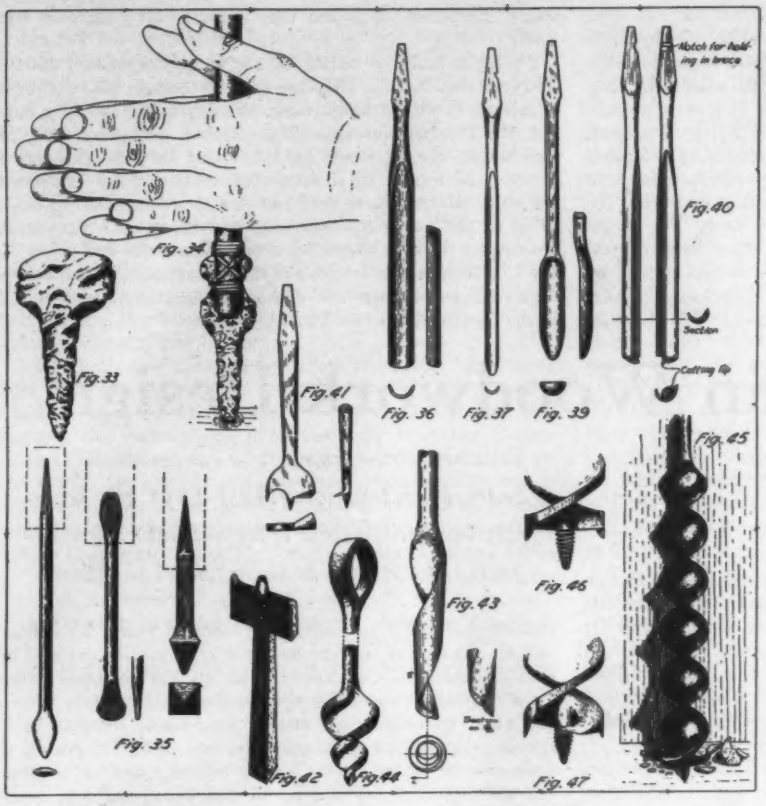
When man learned to use metals, he used these materials for drill bits in making holes in wood. Figure 35 shows some of the metal drills that have been found. They vary in shape and as a rule were made to turn either way. They simply scraped out small particles or reamed small holes larger, in no way cutting a shaving as we expect a boring bit to do now. These crude bits were driven into the end of a wooden shaft and generally revolved by a bow as will be explained in a later article. Sometimes glue, bitumen, or pitch were used to hold the bit in its shaft. No one thought of making the bits interchangeable, but each bit had its own shaft. They were crude implements, judged by today's standards, but they were great improvements over the stone bit for piercing wood.

We do not know with any certainty just which was the first boring tool that improved over the dust-making drill. Probably it was the gouge bit shown in Figure 36. This is only a conjecture, but it seems reasonable when it is known that the ordinary pushed or driven gouge is as old as the Stone Age and that the boring gouge bit differs little from the paring tool. Except for the handle, the boring tool differs only in being sharpened along the sides as well as the end. In operation it was revolved either right or left, or first one way and then the other, which made it an ideal tool for use with a strap or a bow. It left a central core that, unless the hole went through the piece, had to be broken off and dug out. It could not be used for end grain and was not practical for deep holes. For small bits the end was quite rounded and was then commonly called a quill bit (Figs. 37 and 38A). These boring tools were undoubtedly used throughout the Ancient and Medieval Ages, and to so near the present that occasionally one can be found today in an old cabinetmaker's tool chest. They belong to the past, however. No one markets them today.

Another ancient boring tool was the spoon or duckbill bit shown in Figures 39 and 38B. It was also bored either right or left but had two decided merits over the older bit: it bored out the entire hole into true shavings so that it was a practical end-boring tool, and it pulled out its borings when withdrawn for that purpose.

The spoon bit is a very old boring tool. There is some evidence that it was developed in northern Europe, but the earliest specimens are from the camps of old Roman armies. It was probably used throughout the Middle Ages both as a brace bit and as a cross-handled auger. It is pictured in medieval pictures and, as late as 1768, was listed and pictured among the tools of the carpenter and wheelwright.

A tool that at first glance looks like a gouge bit, but on closer scrutiny is seen to be quite an improvement over it, is



the nose bit shown in Figures 40 and 38C. A study of the drawings shows that it makes its hole not by the cutting of a gouge end, but by the paring of shavings by a turned-in cutting lip or router somewhat like the cutting edge of a modern auger. It is a one-direction boring tool, so has only one sharp edge along the reaming trough. It pulls out the shavings, bores both end and cross grain, and is a practical tool for deep boring. This bit was in common use up to a generation or so ago.

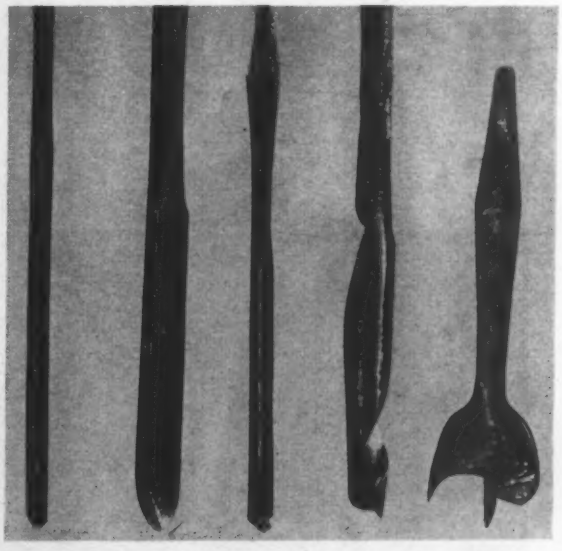
The tool shown in Figure 42 was found in an ancient Roman encampment. It is undoubtedly an ancient centerbit and has every important feature of the centerbit of Figure 41 that was in every cabinetmaker's tool chest 75 years ago. Probably they are still manufactured for shallow boring use. The Roman tool illustrated has such a blunt center point as to suggest that the ancient workman may have used his centerbit to counterbore after a gimlet. Comparison of Figures 41 and 42 shows that two thousand years of evolution did little to the centerbit. Its unknown inventor did quite a thorough job, but, like all his predecessors, his bits had no automatic feed and had to be pressed into the wood continually to keep them boring.

There was one ancient boring tool used both as an auger and as a brace bit that looked something like our modern implements. This was the pod auger or bit. It had a spiral that served less for shaving removal than for feeding the tool into the wood and reaming the hole to size, for the spiral was always tapered somewhat like the modern wood screw. Figures 43 and 38D are of the only pod augers the author has ever seen. It was a very efficient boring tool, especially in end grain. The cutting end operated like a gouge bit leaving a central core that the spiral broke off and held. The outer edges of the spiral helped feed the tool into the work and at the same time reamed the hole out smoothly to the required size. It had to be withdrawn frequently to pull out the shavings.

The pod auger or bit is apparently a very old tool. At least one old Roman pod bit has been found, though a rather crude one. There is a fifteenth-century picture of St. Joseph boring with an auger like that in Figure 44. It is mentioned by writers as being a pod auger and, though it is quite a different tool from the one in Figures 43 and 38D, it does have the characteristic short tapered and side reaming spiral. The German gimlet bit is probably the nearest thing we have today to the old pod auger or bit.

The first long, spiraled, shaving-discharging auger seems to have been that invented by Phineas Cook of England in 1770. It had the long double helix or twist that is used now on the Russell Jennings bit. Figure 45 is the author's understanding of the original form of the bit. The lower end of the spirals ended in curved router-like lips that shaved out the bottom of the hole. It had a leading pivot point like the old centerbit or the screw on the modern bit, but the author is not sure that it had treads on this pivot center. These Cook type bits are still manufactured but now have screw threads on the center. This was the first auger that elevated the shavings from the hole as it bored; all boring tools that preceded it had to be periodically pulled out of the hole to get the shavings out of the way. It still lacked some of the essential of the modern tool: it had no spurs to score the hole to a smooth, perfect round; and it probably had to be crowded by pressure to make it cut.

The really modern auger bit dates from the beginning of the nineteenth century. It was developed in America and several inventors contributed to its perfection, but their individual contributions are not quite clear. Knight's *American Mechanical Dictionary* states, "Lilly and Gurley, both of Con-



A B C D E

Fig. 38. At A is shown a quill bit; at B, a duckbill bit; at C, a nose bit; at D, a pod auger, and at E, a centerbit

necticut, invented the auger bit about 1800, but the first patents were to Hoxie (1804) and Hale (1807)." However, L'Hommedieu made some improvement in the auger in 1809, so that by that time it had become quite modern-looking. See Figure 46.

Other patents followed and, like a large per cent of patents, amounted to no permanent improvement, until in 1850 Russell Jennings patented the extension lip. Most people familiar with auger bits think of Jennings' name as associated with the double-twist bit in which style his bits are made, but his invention consisted in placing the scoring spur back of and under the router or cutting lip. The difference can be seen by comparing Figures 46 and 47. It scored a perfectly circular hole ahead of the cutting lip and left the lip so it could be easily sharpened. It is the most popular bit ending in use today.

There are quite a variety of augers on the market today. They survive because they are best for certain kinds of boring — the Irwin for tough work, the ship auger for deep boring, the Forstner for smooth or shallow work, the drill for end boring, etc. It would be interesting to some readers to recount the history of these several tools, but for the most, the story of auger bits need not include them. The development of the boring tool has been a series of man's attempts with many devices, which, by a process of trial and rejection for a better one, has resulted in the evolution of the bit into a highly efficient boring tool — an instrument as efficient as any in the woodworker's tool kit.

Indian Art in Woodwork Design

William W. Wills

Junior High School,
Rapid City, South Dakota

This article embodies a suggestion that bears consideration. Most boys are interested in Indian lore. Why not have them express this interest in their school shopwork?

THE American people, in their liberal adoption of foreign art motifs in the design of their home furnishings and decorations, have overlooked an interesting and beautiful art culture that is native to their own continent. The American Indian, before his subjection to the white race, had developed an art culture that is fast disappearing at the present time. Yet, ethnologists and art authorities are agreed that, racially, the Indian is more artistic than his white conqueror.

This fact is not difficult to understand after the civilization, personality, and psychology of the Indian and the character of his art have been considered. First of all, the Indian has remained thoroughly an Indian. His mode of living, his beliefs, and his manner of thought have not been greatly changed by outside influences. Consequently, his art has not been defiled by a dominating race. For ages he has lived close to nature, the great inspiration for artistic expression. Because he is deeply religious, highly imaginative, and definitely poetic, he feels an urge to express the beauty he sees and feels in reverent and beautiful fashion. In all that he attempts he is extremely patient.

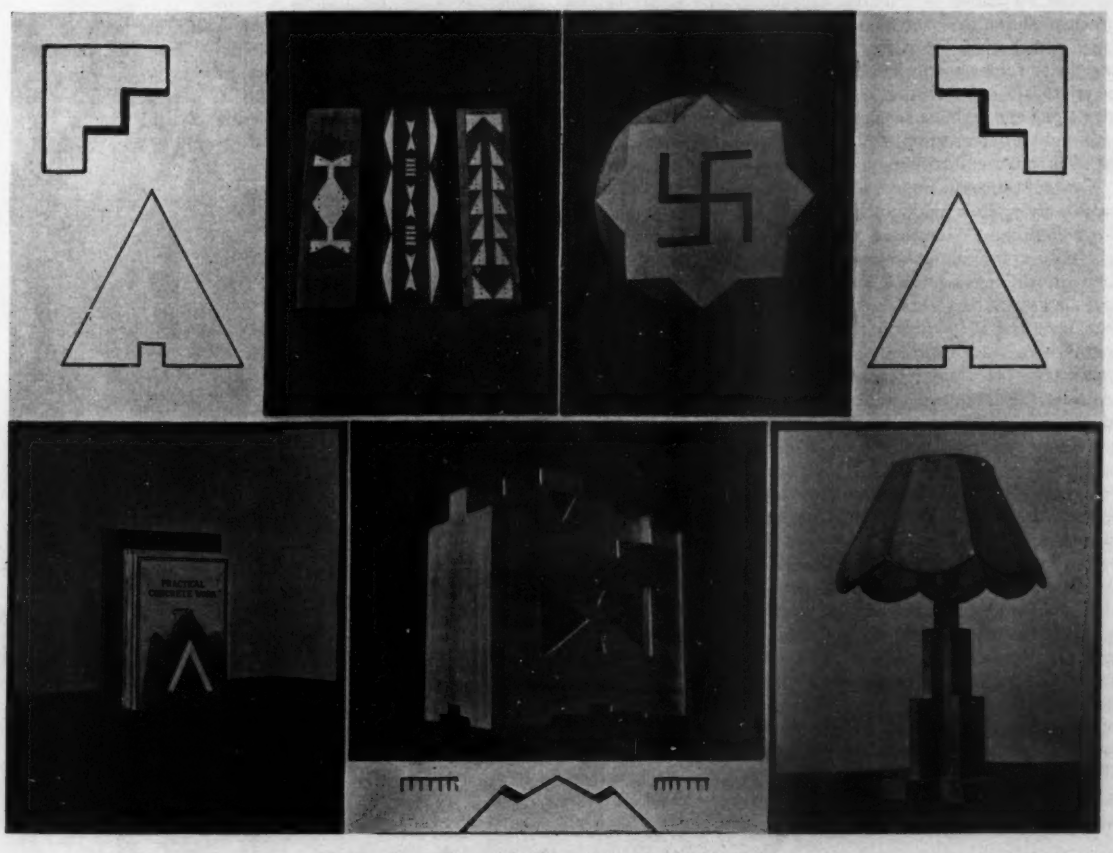


Fig. 1. Examples of Indian art in woodwork design

He has not permitted his art to become commercialized. Neither has his artistic expression been affected by a desire for personal glory or prominence. Lastly, Indian art is symbolic. Through his art, the Indian has preserved the history and legends of his race. Consequently, Indian designs can be enjoyed quite as much for the stories they tell as for the beauty that derives from their symmetry and rhythm.

While it is true that Indian art is as characteristic as the race itself, it must be further understood that American Indians do not all use the same forms or methods of art expression. Ethnologists have divided the Indians of the United States into seven culture groups as follows: Eastern Woodland, Southeastern Woodland, Northwest Coast, Californian, Southwestern, Plateau, and Plains.[1]

In general, the tribes east of the Mississippi use curved lines and conventionalized floral designs in their artwork. Angular forms are rarely used. The Western Indian, and particularly the Plains tribes, differ markedly from the Eastern group. Curved lines and floral designs are not used. Instead the figures are angular and are usually purely geometric in appearance. Figures of horses, buffalo, birds, and other creatures, tepees, human figures, and other highly conventionalized designs in geometric form are found abundantly.[2] These forms are symbolic, and as such serve the dual purpose of decoration and conveyance of meaning.

In designing the woodwork projects shown in Figure 1, symbols and conventions of the Plains tribes have been used exclusively. Because of the geometric form of these symbols, the pieces quite closely resemble the modernistic small furniture so popular at the present time. The value and interest of these projects are heightened by the fact that in the design of each article, the symbols used have been combined in such a way that a story is told or a definite meaning is conveyed.

Most of the symbols used in the design of the project shown are taken from beaded articles made by the Sioux tribes of the Dakotas. These particular Indians, of fierce and warlike character, have preserved much of their interesting history and tradition in the beadwork which is their chief form of artistic expression. The symbols may be used either singly or in combination. They are shown, together with their meanings, in Figure 2.

The inlayed cribbage boards show examples of several of the most commonly found Plains Indian symbols. This simple inlay of the first of these boards uses two symbols: the forked tree (party of braves on the warpath) and the diamond-arrow design (battle or fighting). The story told by the combination of these symbols is easily interpreted. It chronicles the occurrence of a battle between two parties of braves who happened to meet while on the warpath.

The center board of the three carries a design that was taken without change of form from a beaded tepee dew cloth, a broad strip of tanned skin placed around the bottom of the tepee for the exclusion of the elements. This design brings three other symbols into use. The elongated-diamond symbol (men or human life) along the edge, and the arrowheads point-to-point (desperate fighting), together with the

[1] Salomon, Julian Harris, *Indian Crafts and Indian Lore* (New York: Harper and Brothers, 1928), p. 4.
[2] Verrill, A. Hyott, *The American Indian* (New York: Appleton, 1927), p. 303.

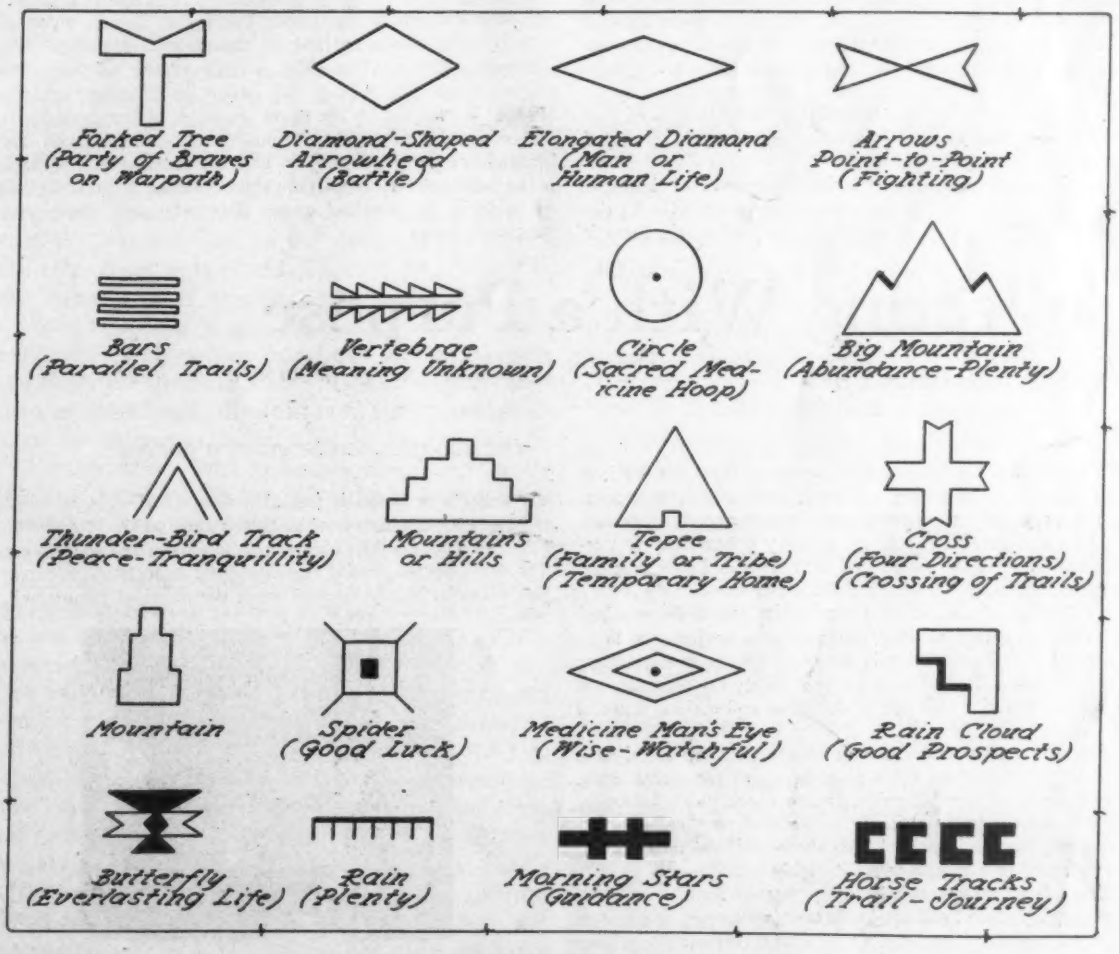


Fig. 2. Typical Plains Indian design elements

bars (parallel trails) clearly tell the story of a series of pitched battles causing many deaths, between two enemy tribes traveling parallel trails.

The other of the three boards has an inlayed design that is of unusual interest. It is known as the vertebrae design and authorities are not agreed as to the meaning it carries. It is, however, one of the most frequently used of all Plains Indian designs. Because the vertebrae is a strong but vital part of the body, it is thought that the design indicates life or strength.

The cake board, although circular in form, is truly Sioux in design. To the Sioux, the circle (medicine hoop) is of sacred character, and it is used only when the protection and guidance of the Great Spirit is needed. As might be expected, the cake board represents a battle shield. The circular form of the shield affords divine protection to the warrior wearing it. The inlayed swastika is the good-luck design commonly used by primitive people the world over. The elongated-diamond design in red around the edge is a badge of honor for the owner. It shows the number of wounds that he has inflicted upon his enemies. If the diamonds are painted blue or black it indicates even higher honor, showing the number of enemies the wearer has killed in battle.

Not all Indian designs have such fierce and bloody interpretations. The book end shown in Figure 1 is of much gentler character. The inlayed thunder-bird-track design (peace and tranquility) combined with the big-mountain symbol (abundance and plenty) outline make a good-luck book end that conveys the wish that good fortune may come to the home in which it is placed.

Another method of utilizing Indian symbols in woodwork design is illustrated by the cut-out pattern on the magazine rack. In this project, the step design (range of low mountains or hills) is employed for the outline of the sides, middle pieces and ends, and the triangular tepee symbol (family or tribe) is cut out in the side pieces. The story here is of two tribes of Indians who lived in a valley between two ranges of hills.

Boys in junior-high-school woodwork classes find the table lamp shown in Figure 1 a very interesting project. In its design, two common symbols are used. The base of the lamp is made in the shape of the cross symbol (crossing of trails). The mountain symbol is used in the design of the upright. Since no signs of battle are evident, the story of the lamp may be interpreted as telling of two friends whose paths met and crossed at the base of a mountain.

In Figure 2 are shown design elements commonly used in Plains Indian artwork design. For woodwork-project design, they may be used singly or in varied combinations. For this use they are of greater interest to the boy and of more value in the project if their meanings are not ignored. The thunder-bird-track design indicating peace and tranquility would hardly be compatible with the diamond-arrow design indicating battle and bloodshed. However, if the meanings of the various symbols are not taken into account, the number of effective combinations is greatly increased. It is entirely possible for a boy to use these symbols in designing a project that tells some story of his own experiences.

A woodwork project, if it is worth while as an instructional device, should provide some incentive for study in classes outside the shop. The suggested use of Indian symbols in woodwork design satisfies that requirement. The opportunities for articulation with art classes are numerous. In building one of these projects, the student will find inspiration for many English composition topics, and will become interested in American literature pertaining to Indian life. His understanding and appreciation of the domestic history of the United States will be deepened. The interest of the student in his social-science study of the present problems of the Indian will likely be increased.

Through these projects and others of a similar character, it is possible to accomplish much that is desirable in a junior-high-school woodworking course. The Indian feature serves as a motivating device to interest the student in the projects offered for his selection. The novelty of the story in each project appeals to the boy. His desire for adventure and the unusual is gratified by the novel character of the projects. In the interpretation of the various symbols, his interest and imagination are challenged. Of greatest consequence, perhaps, is the fact that the completed projects arouse a deeper feeling of pride in the youthful owner than projects of more conventional design.

Collecting With a Purpose

Max Chambers

Preston, Maryland

In this, the fifth article on hobbies, the author shows how the collective instincts of the hobbyist can be given a purpose.

CREATIVE hobby riding in the form of collecting is a highly commendable endeavor, and should be encouraged as a regular part of every boy's growth and development. Teachers and parents should grasp every opportunity to promote and increase the interest of their boys and girls, but the collection should go on with a definite purpose in view.

A collection should not be a conglomeration of disorganized material, but, rather, a collection based on a project — collecting with a definite objective in view — a goal to shoot at. The real test comes from the collector's ability to organize and utilize the material collected in designing and making a useful project.

The illustration shows a map of the United States, with each state represented by a piece of wood from that state. Those pieces of wood didn't mean so much until they were cut out and set in their proper places. But now, see what an interesting project it makes! This shows how one material can be organized in a way to make it highly satisfying.

There is no reason to believe that stamps cannot be made into maps, pictures, puzzles, book ends, wallpaper, and dozens of other utilitarian projects. Other collections can be utilized accordingly. A collection affords satisfaction of a high type, but is really the minor part of the real purpose, for what the boy collects or makes is just a by-product of what he learns. It is a good graph on how he thinks and feels.

The old-time hobby riders just sat and whittled shavings. The boys of 1934 build life into their collections. What are you doing to help your boys meet the needs of tomorrow?

Map of the United States made of a piece of wood from each state

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

The Need Today

It is quite common, nowadays, to read in daily as well as in educational papers, that the enrollments in high schools are increasing year after year. There are some high-school teachers who look upon this popularizing of secondary education with evident disfavor. In the good old days, say these objectors to the present increased high-school enrollments, only the better students went to high school after finishing their elementary-school course. With these brighter students only, the standards of the high school could be maintained at a high level. Under present conditions, these standards have to be lowered to accommodate the heterogeneous group of students whose numbers are increasing from year to year.

It may be true that the smaller groups who entered high school in years gone by represented a more select body of students, as far as academic attainments are concerned, but is it not dangerous to take it for granted that they were the better students?

It is true that genius perceives in a flash what the normal person understands only after painstaking study. But has the high school of the past any evidence which will show that there were not many good students who finished elementary school, but never entered high school? Is there any evidence to show that the standards set up for those in high schools represent the standards that ought to be achieved by the majority of the students?

When high schools were engaged mainly in preparing aspirants for college entry, they had to meet the standards set by those who dictated college-entrance requirements. Even then, however, the many were made to conform to the norm set for the favored few.

Whether or not the standards in the past were the ones best fitted for the boy and girl who have to enter and adjust their personalities to a society as complex as our present civilization, is a grave question.

Is it not better, then, to stop bemoaning the fact that a large number of those now entering high school do not excel at the abstract types of studies, which, it is quite commonly agreed, are not taught so that they will fit for life, and develop methods and courses which more nearly fulfill this necessary requirement?

If this were done, industrial-arts work in the high school would come into its own. No longer would the teachers of the old-type studies tell the students who lost interest in dead, unmotivated work that they were fit only for shopwork. Teachers who do this, merely advertise their own lack of knowledge of the real things in life. They show that they do not know that school shopwork, if it is worthy of the name, embodies and offers a great deal more than mere manual skill and dexterity — that industrial-arts work is ideally suited to lend to studies that direct application to life situations which many other studies now lack. These teachers also show that they fail to grasp the fact that shopwork contains the essentials of many of those human experiences which the student of today must put into practice tomorrow.

It will be well, then, for the old-time high-school teacher to take careful stock of his offering to education. Close study of his own work may show him that the new deal asks not how many students are unable to profit by his work, but rather how he can adapt his work so that an increased number of students can gain an insight into and the ability to cope with problems which will confront them in their lives.

Probably this self-analysis will show that the blame cannot be placed wholly on mediocre students, but that much must be ascribed to antiquated subject matter, teaching methods that are not up-to-date, lack of understanding of modern educational philosophy, and a lack of understanding of the fact that the needs of the students and not mere subject matter must be the guiding principle of those who would make secondary education of real help to the young people who are entering high schools in ever-increasing numbers.

Industrial-arts teachers have a real duty to perform in this regard. They, too, must view their work not as a narrow subject but as a part of a broad educational offering which cannot be satisfied by a mere making of projects, but rather by real effort to make that project a vehicle for something which extends beyond the school shop and into every classroom.

Since the average high-school teacher does not make an effort to use the enlivening effect of practical work in his course, it is the industrial-arts teacher who must make the effort to show just how his shopwork may be used in the language classes, in mathematics, in science, in civics and social classes, and even in the geography and history classes.

Co-operation Required

On November 19, 20, and 21, a conference was held at Washington which promises much for the future of industrial-arts work in the United States. At this conference, Maris M. Proffitt, Federal Office of Education Counselor, served as leader. Around the table sat some of the most able and thoughtful leaders of industrial education.

It is the purpose of those who attended this conference to provide a clear objective program which can be translated into action by school administrators in rural districts as well as in the smaller and larger cities. If the effort which these leaders of industrial-arts work are expending in the development of the plan is to be worth anything, every industrial-arts teacher must not only strive to understand the plan which they are going to formulate, but each and every one must feel it his duty to do everything in his power to make that plan work. If that is done, industrial-arts work will never again be jeopardized as it unfortunately was during the past few years.

Informal Tests

TRADE TEST ON STORAGE BATTERIES

J. W. Fleming, Vice-Principal, Clifford B. Connelley Trade School, Pittsburgh, Pennsylvania

Walter B. Jones, University of Pittsburgh, Pittsburgh, Pennsylvania

THIS trade test in storage-battery work was developed and standardized at the University of Pittsburgh for the selection of student teachers in vocational education. It is one of several tests now in use for measuring and rating a candidate's trade skill and knowledge.

The plan of student selection devised in the department of vocational education at the University of Pittsburgh for which this test was developed, consists of the following parts: (1) trade tests, (2) mental-ability tests, (3) oral and written English tests — diagnostic and remedial, (4) special relations test, (5) interest analysis, and (6) personal interviews for personality rating.

This particular trade test is one of a series for measuring the essential trade information, knowledge, and skills for an automobile mechanic. It is organized on the following analysis of the gasoline automobile.

Analysis of the Automobile

The automobile analysis on which the tests are based was divided into the four parts indicated, with a second subdivision consisting of from five to eight parts.

A. *Running Gears and Body* — (1) tires and tubes, (2) springs, (3) brakes, (4) wheels and rims, (5) frames, (6) front axle, (7) snubbers, (8) fenders and body.
B. *Power Generation* — (1) engines, (2) gasoline systems, (3) cooling systems, (4) lubricating systems, (5) exhaust systems.
C. *Power Transmission and Control* — (1) universal joint — drive shaft, (2) rear axle and differential, (3) steering mechanism, (4) clutch, (5) transmission.
D. *Electrical System* — (1) lighting system, (2) ignition system, (3) storage battery, (4) starting system, (5) generation.

Description and Purpose of the Automobile Storage-Battery Test

This test consists of four parts: Oral, written, procedure, and performance.

Oral Test. The oral test is so devised as to give the candidate an opportunity of expressing himself freely on the question and yet be required to give a specific answer. When testing individuals, this test is used as an oral test and the answers are recorded at the time of the interview. For group testing it may be used as a written test.

Written Test. The written test includes the true-false, the five-point multiple choice, the matching, and the picture forms. Two types of questions were recognized in the organization of this test: (*a*) the type of question that deals with the technical or related phase of the work, and (*b*) the type of question that deals with the actual doing of the job.

Procedure Test. The procedure test consists of a number of statements of what to do when assembling a storage battery. They are not arranged in the proper order of procedure. The candidate taking the test is to place in the parentheses to the right of the statement a number indicating the order of sequence in which he would do the job. A similar test on the disassembling of a storage battery is given and the same procedure is followed.

One not familiar with automobile storage-battery servicing and repairing would have difficulty in noting what should be done first, second, third, etc., noting the correct order of procedure, whereas the mechanic who knew his job would have little difficulty in noting what to do and when to do it.

Performance Test. The performance test is designed to measure the degree of skill possessed by the candidate in doing a specified job. The test is to be given in a laboratory or shop under the observation of a skilled examiner.

This automobile storage-battery test may be used (1) in technical schools and colleges for selecting potential automobile teachers requiring a knowledge of automobile storage-battery work; (2) in industry to select personnel for automobile storage-battery work; (3) in vocational schools for measuring and rating the progress of the student enrolled in the storage-battery department.

Construction and Validation of the Test

The selection of items in this test has been based on information obtained from a number of sources: blue prints, cuts, shop manuals and charts from manufacturers of autos and auto parts; textbooks, courses of study; personal interviews with automobile mechanics and instructors teaching automobile work. Care was exercised in selecting items, or what may be termed learning factors, that the mechanic, the instructor, employer, and manufacturer of auto parts considered essential in automobile storage-battery service and repair.

Reliability of the Test

An indication of the reliability of the test is shown in the following manner: The groups tested were representative groups classified as novices, apprentices, journeymen, and experts. They represented four levels of trade skill and knowledge pertaining to the storage-battery field. The novice knows little or nothing, the apprentice knows enough to be a useful member of the group under supervision, but is not capable of working without direction and supervision; the journeyman knows how to do the job quickly and well; the expert has a high degree of trade ability. The novices were a group of girls in preparation for teaching; the apprentices were students in the Pittsburgh trade schools; the journeymen were men with six or more years' experience in automobile storage-battery work; the experts were employees of the Exide Battery Co., rated as expert battery men; and a group of experts teaching this work.

By comparing the individual's score, made on the test, with the rating given him by the previous classification, we find both ratings in agreement. Those individuals classed as novices were found in the lower score level; those classed as experts in the upper score level. The apprentices' and journeymen's scores were found in the intervening levels,

the journeymen higher than the apprentices but lower than the experts. Slight overlapping exists between the extremes of the four distributions.

The technique[1] used for determining score levels and selecting differentiating questions is similar to that used in developing the Army Trade Test.

[1]Chapman, J. C., *Trade Tests*, pp. 101–103, and Fleming, J. W., M.A. Thesis, University of Pittsburgh, 1929.

Storage-Battery Test

Sample questions taken from each form of the test are produced below. The total number of questions in the test is 128.

Oral Test

Directions to Examiner: Read the question exactly as it is given and record the response on separate scoring sheet. Do not assist the candidate with leading questions.

1. What is the liquid or solution used in a storage battery called? _____
2. What is the name of the acid used? _____
3. What is the name of the other liquid used? _____
4. Is the specific gravity reading higher or lower when battery becomes discharged? _____

Written Test — Part I

Directions: Write in the parentheses the letter T or F to indicate whether you believe the statement to be true or false. Do not guess. False statements are penalized heavily.

Sample

A slight short circuit in the external wiring will cause a battery to lose its charge slowly. (T)

1. The breaking down of the wood separators has no effect on the battery holding its charge. ( )
2. A short circuit in the external wiring will cause the battery to go dead. ( )
3. When the plates buckle they will puncture the separators, but have no effect on the current supplied by the battery. ( )

Written Test — Part II

Directions: Place a line under the word or phrase that you consider the correct answer to the statement or question, and place its number in parentheses to the right of the question.

Sample

The generator, when charging an insufficient rate, will cause:
(1) Sulphation of plates; (2) Separators to crack; (3) Terminal to loosen; (4) *Low specific gravity;* (5) High specific gravity. (4)

1. When plates are not kept covered by the electrolyte it causes:
(1) Corrosion; (2) A cracked jar; (3) Broken separator; (4) Broken plates; (5) Sulphation. ( )
2. Too many electrical accessories on the automobile will cause a:
(1) Short circuit; (2) Loss of cranking power; (3) High specific gravity; (4) High voltage; (5) A ground. ( )

Fig. 1

3. If the engine is not driven fast enough to charge the battery at a sufficient rate, it will cause:
(1) Sulphation of plates; (2) An excess of acid in the electrolyte; (3) Buckled plates; (4) Loose connections; (5) Dim lights. ( )

Written Test — Part III

Storage Battery (Locating and correcting trouble).

Directions: Place a line under the statements which cause the trouble indicated by the symptom. Next place the number of the best remedy shown in the parentheses after the causes.

Sample

Symptom

Battery loses charge slowly.

Cause

a) Slight short circuit or accidental ground *in external wiring.* (3)
b) Battery frozen. ( )
c) Battery undercharged. ( )
d) Wood separators *starting to break down.* (1)
e) Battery shorted by *sediment.* (2)

Remedy

(1) Reinsulate battery. (2) Clean out sediment. (3) Repair wiring. (4) Not advisable to repair. (5) Have gravity balanced by competent battery man.

1. Battery suddenly goes "dead."
a) Short in external wiring. ( )
b) Battery discharged. ( )
c) Broken jar or cover. ( )
d) Wood separators punctured by buckled plates. ( )
e) Foreign substance may have been put in battery. ( )
f) Adding acid instead of water. ( )

Remedy

(1) Repair wiring. (2) Reinsulate — new plates may be necessary. (3) Try long charge at low rate. (4) Try long charge at one-half finish rate. (5) Recharge. (6) Repairs depend on character of impurity.

Written Test — Part IV

Storage Battery (Name of Parts)

Code No. D–3–b

Herewith are shown pictures of the parts that go into the making up of a storage battery and a cross section of a vertical section of part of a grid.

Each part is numbered. You are to write the correct name of the part after the number.

Example

Fig. 1: Vertical section through grid.
Fig. 2: _____
Fig. 3: _____
Fig. 4: _____

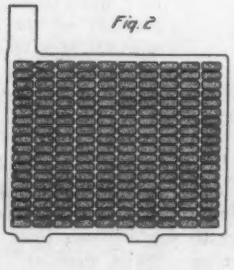


Fig. 2

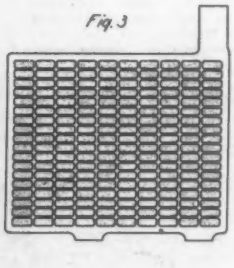


Fig. 3

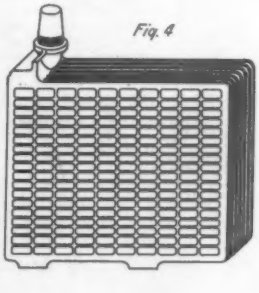


Fig. 4

Procedure Test — Part I

Directions: The following include all the necessary steps in the *building of an automobile storage battery, gasket-sealed,* the same as found in an Exide, Westinghouse, Globe, etc.

Place yourself in the position of a battery repairman building up a battery in a battery repair shop, using new material.

You will note that the order of procedure given below is wrong. Write the number in the parentheses following each statement to indicate the order in which the operations should be performed.

1. Place battery on charge..... ( )
2. Seal covers ..... ( )
3. Fill battery with electrolyte..... ( )
4. Clean plate lugs (by using a file) ( )

Procedure Test — Part II

Directions: The following include all the necessary steps in *dismantling or tearing down an automobile storage battery, gasket-sealed,* the same as found in the Exide, Westinghouse, Globe, etc.

Place yourself in the position of a battery repairman in a battery repair shop called up to dismantle a battery for rebuilding.

You will note that the order of procedure given below is wrong. Write the number in the parentheses following each statement to indicate the order in which the operations should be performed.

1. Pull the element from the jar.... ( )
2. Estimate the repairs..... ( )
3. Remove links and terminals..... ( )
4. Center punch links and terminals ( )

Performance Test

Directions: You are instructed to assemble, place on charge, and test the battery in accordance with the following instructions. The examiner will record the time required to complete the job. He will also inspect the progress of the job at various times and score the final product.

1. Adjust burning rack for correct plate height.
2. Set plates in burning rack with strap.
3. Clean plate lugs, and straps for burning.
4. Set up burning outfit to use natural gas and oxygen.
5. Adjust torch for natural flame.

6. Burn plates into groups.
7. Fit covers.
8. Cut and install separators.
9. Place elements in jar.
10. Seal covers.
11. Burn on links.
12. Mark battery for polarity.
13. Mix electrolyte.
14. Fill battery with electrolyte.
15. Let stand about eight hours, then place on charge.
16. Adjust charging rate for beginning rate, adjust as battery becomes fully charged.
17. Test and Records.
    Specific gravity .....
    High rate discharge .....
    Cadmium Test .....

MECHANICAL-DRAWING TEST FOR SECOND-YEAR STUDENTS IN HIGH SCHOOL

Hugh Norris, Director Industrial Arts, East Central State Teachers College, Ada, Oklahoma

The mechanical-drawing test described herewith was designed several years ago for students who were in their second year of drawing. The students tested were from four states, three in the middle west and a school in New York City, a total of nine secondary schools. In all, 160 classes were reported.

This test was based on the textbook, *Mechanical Drawing for High Schools,* by Carl Svensen. It consists of three main exercises under which are subdivisions. The first exercise is composed of five general statements relative to *lettering* that is used in the drafting room, and *instruments and their use.* Under the latter are a like number of statements pertaining to their use in the drafting room. In this exercise the student places a minus sign (—) for false statements, and a plus sign (+) for true statements. In cases where the student doesn't know, he is asked to guess; in this manner all statements are marked. In this exercise approximately half are true and half are false.

SCORES OF DIFFERENT SCHOOLS										
Grades	School No. 1	School No. 2	School No. 3	School No. 4	School No. 5	School No. 6	School No. 7	School No. 8	School No. 9	Total
99 to 95	7					1		1	4	13
94 to 90	4	6			2	1	1		6	20
89 to 85	3	1	2		2	3	2	1	3	17
84 to 80		2	1		1	3	3	2	4	16
79 to 75		3	1	3	2	1	2	2	1	15
74 to 70				7	2	1	2	2		14
69 to 65				4	2	3	3	3	1	16
64 to 60			3	4	1	1	2	3		14
59 to 55			2	4	1	2	1	2	1	13
54 to 50		1	3	3			2	1		10
49 to 45			1	2			1	1		5
44 to 40				1			1	1		3
39 to 35							1			1
34 to 30										
Total	14	13	13	28	13	16	21	19	20	157

Distribution of the Nine Schools

Note: The first two schools are the results of teachers who were former students of the writer, and the last one is directed by a classmate of the writer.

In the second exercise the *character of lines, angles and circles, and straight lines and solid figures* are treated. Under each of these headings there are five statements relative to the correct usage in drafting-room practice. In this exercise the student is confronted with a multiple choice of words and statements. In each case he has a choice of four words or statements, and he is asked to underline the one that makes the truest statement.

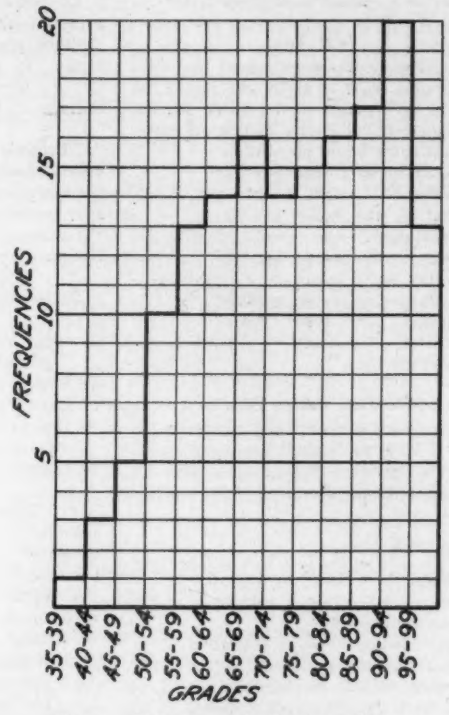


Fig. 1. Histogram of all nine schools

The third exercise is an *association* test which consists of 25 sketches and symbols that should be familiar to students after one year of drafting. The student is asked to place a number corresponding to a given symbol, before certain words or statements.

In studying the distribution of the schools, it will be seen that in schools 1, 2, and 9 the grades ran up to the upper 90's. The instructors in the first two are former students of mine, and the instructor in the ninth school was a classmate of mine. These men, due to their training, therefore, may be emphasizing certain subject matter that other teacher-training men may not be stressing. With this fact in mind, it may be easy to see why the students in these three schools ranked so high. These instructors are "carrying on" to some extent what they were taught. This is also very noticeable in the histogram of all the schools, Figure 1. Taking all nine schools together, it is readily seen that the test is too easy, although the curve shown in the histogram for schools Nos. 3, 4, 5, 6, 7, and 8 is not so bad.

Exercise I

Approximately half of the following statements are true and half are false. Place a plus mark (+) before each statement that you think is true, and a minus sign (—) before each which you think is false. If you don't know which sign to make, guess.

PUBLIC LIBRARY
DETROIT MICH.

Lettering

1. ( ) Lettering a mechanical drawing is of great importance, for poor lettering not only increases the liability of error of construction, but spoils the appearance of the best drawings.

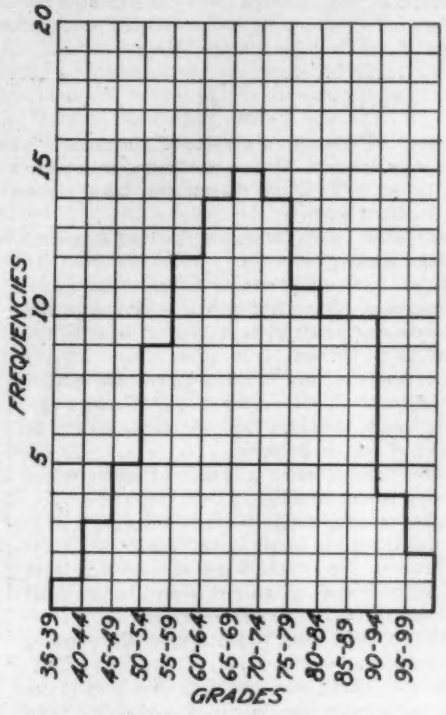


Fig. 2. Histogram of schools Nos. C, D, E, F, G, *and* R

2. ( ) Lettering in pencil should be done with 2H pencil, sharpened to a round point.
3. ( ) The successful draftsman and drafting student are not so painstaking and careful of little details.
4. ( ) Only one kind of lettering is used in mechanical drawing. That is Vertical Gothic.
5. ( ) Horizontal guide lines are always necessary and at first vertical or slant lines must be drawn, for nothing looks worse than to make letters of different heights and different slants.

Instruments and Their Use

1. ( ) The ruling pen is used to draw ink lines with the aid of the T square, triangle, or scroll as a guide.
2. ( ) The compass is provided with a pen and pencil, either one of which may be inserted in one or both legs of the compass.
3. ( ) The upper edge of the T square is used for drawing horizontal lines, and as a rest for the triangles.
4. ( ) The ruling pen is filled by inserting it in the ink bottle to a depth of ¼ in.
5. ( ) The dividers are used for larger spacing, and for transferring distances from one point to another.

Exercise II

Directions: Underline the one of the answers in the parentheses which makes the truest statement.

Character of Lines

1. The object lines of a drawing should be a (light, dot-and-dash, short-dash, heavy) line.
2. The center line is made by a (dotted, short-dash, dot-and-dash, long-dash) line.
3. When inking-in a drawing, I would first draw the (border, object, center, section) lines.
4. The lines connecting any parts of a drawing are (dimension, extension, section, center) lines.
5. The dimension, or arrowhead lines are (dotted, fine solid, heavy solid, heavy dotted) lines.

Angles and Circles:

1. Angles are measured in (rods, meters, degrees, fathoms).
2. An obtuse angle is (greater, the same, smaller, longer) than a right angle.
3. A right angle has (45°, 90°, 180°, 360°).
4. The radius of a circle will step around the circumference (three, four, six, eight) times.
5. Any straight line passing through the center of a circle, from side to side, is a (tangent, arc, radius, diameter).

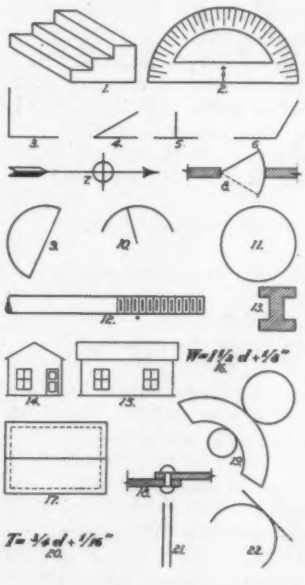
Straight Lines and Solid Figures:

1. A regular polygon cannot have (two, three, four, six) sides.
2. A rectangle is a straight-line figure whose opposite sides are (equal, not equal) and whose angles are (right angles, or not right angles).
3. A cube might have (three, four, six, eight) sides.
4. The section of a cone, pyramid, or prism that is left after the upper part has been cut off is called (cylinder, sphere, truncated, solid).
5. A triangle which has three equal sides is a (right-angle triangle, equilateral triangle, parallelogram, rectangle).

Exercise III

Association Test for Mechanical Drawing

Directions: Identify each of the symbols shown by placing the proper number before each of the names.



( ) Right angle
( ) Circle
( ) Semicircle
( ) Obtuse angle
( ) Tangent
( ) Parallel lines
( ) End view
( ) Acute angle
( ) Truncated
( ) Top view
( ) Development
( ) Side view
( ) Threads
( ) Radius
( ) Direction
( ) Section
( ) Swing door
( ) Riveting
( ) Thickness of nut
( ) Isometric projection
( ) Eraser
( ) Protractor
( ) Width of nut
( ) Perpendicular
( ) Lettering

TESTS FOR HAND FIBER WEAVING

Emil Gandre, Sheboygan Vocational School, Sheboygan, Wisconsin

This informal test, which may be used in junior and senior high schools and in vocational schools, consists of five parts, only two of which are published herewith.

Part I consists of 45 statements of a true-and-false nature, pertaining to technical and related information. The student should be able to answer at least 4 statements in a minute.

Part II consists of 125 true-and-false statements pertaining to processes.

Part I

Directions: Below are a number of statements which are either true or false. If the statement is true, encircle the capital T; if false, circle the capital F. *Do not guess,* as each incorrectly marked statement counts against your score.

Example: One of the ingredients in catsup is tomatoes .....(T) F.

1. Fiber is made from wood pulp..... T F
2. Fiber can be stained..... T F
3. Fiber furniture can be finished without being glue-sized ..... T F
4. Rock elm is chiefly used for constructing frames T F
5. Nail holes need not be bored before assembling a frame ..... T F
6. Fiber is lighter in weight than reed..... T F
7. In weaving, a combination of reed stakes and fiber is mostly used..... T F
8. Some stakes are made with a steel core through the center ..... T F
9. Fiber will sometimes unravel during the process of weaving ..... T F
10. Fiber can be made in various shades of color... T F
11. All stake holes should be bored before assembling the frame..... T F
12. Rock elm splits easily during the process of bending ..... T F
13. Large rolls of paper are cut into smaller rolls ready for staining ..... T F
14. Stakes are made on a stake machine..... T F
15. After staining the small rolls, they are placed into the spinners..... T F
16. Flat fiber is made by passing the round fiber between a pair of rollers..... T F
17. Always wet the fiber before using it..... T F
18. Glue size is used to stiffen the fiber..... T F
19. Fiber furniture can be finished with shellac..... T F
20. Fiber cracks and reed does not..... T F
21. Most factories spin their own fiber..... T F
22. To make colored fiber the paper must be stained before it is spun..... T F
23. A stake spinner is similar in construction to a fiber spinner..... T F
24. Another type of stake is made without a wire core ..... T F
25. Most factories make their own fiber and stakes, because it is cheaper..... T F
26. Water stain is used to stain the fiber..... T F
27. Chloride of lime is used to set the color fast in the paper ..... T F
28. Lacquer is cheaper to use over colored fiber.... T F
29. To make glued stakes we use glue size..... T F
30. A "one-tone finish" is made with one flat color, covered with varnish..... T F
31. Potash is mixed with the water stain to set the color in the paper..... T F
32. Two coats of varnish are chiefly used for covering one-tone finishes..... T F
33. Bronze powders are mixed with bronzing liquids T F
34. Turpentine is used to thin varnish..... T F
35. Varnish dries quicker than lacquer..... T F
36. Lacquer is thinned with a lacquer thinner..... T F
37. To make "two-tone finishes" enamel is chiefly used for the first coat..... T F
38. Bronze powders cannot be used over enamel.... T F
39. Betha Napthol is added in glue size to prevent it from giving an odor..... T F
40. Rock elm must be steamed before it can be bent T F
41. Fiber furniture will not wear so good as reed furniture ..... T F
42. Fiber furniture is given two coats of glue size before finishing ..... T F
43. The glue size should be boiling when dipping the furniture..... T F
44. Bone glue is used for making glue size..... T F
45. Glue-sized furniture will absorb the paint better T F

Right:	.....	Score: R.—W.	
Wrong:	.....	Right:	.....
Omitted:	.....	Wrong:	.....
Total:	.....	Score:	.....

Part II

Directions: Below are a number of statements. Some are true and some are false. If the statement is true, place a circle around the letter T; if the statement is false, place a circle around the letter F.

Do not guess: Each incorrectly marked statement counts as a penalty against you.

Example: Buffalo Bill was an Indian chief..... T (F)

1. The reason for spacing stakes according to the various specifications, is to give strength to the part to be woven..... T F
2. It is easy to weave when stakes are placed closely ..... T F
3. The length of stakes depends on the height or width of part to be woven ..... T F
4. Allow 8 inches extra to length of stakes whenever a border is desired ..... T F
5. Stakes serve as supports for weaving..... T F
6. A nail is used to locate stake holes..... T F
7. Whenever the stake holes are covered with winding or weaving, an awl is used to pry apart so that the stakes may enter freely..... T F
8. The process of tying stakes is used where nailing is forbidden..... T F
9. The front skirt, seat, and back of a project can be made with one length of stakes by using the tying method..... T F
10. Stakes are usually nailed in pairs..... T F
11. Twenty-inch stakes are standard for seats which are separately woven..... T F
12. The average seat is 20 inches front to rear..... T F
13. It is very essential properly to manipulate the fingers and hands to do the weaving most effectively ..... T F
14. The thumb and second finger of the left hand are used when weaving between two posts..... T F
15. When the fingers of the left hand hold the weaving down, they at the same time serve as guides to hold the stakes upright..... T F
16. During the process of weaving, the thumb places the strand behind the stakes and the second finger receives it and pulls it in front of the stakes ..... T F
17. To get the proper effect in weaving, tension on the woven strand is of minor importance..... T F
18. The proper amount of tension to use is easily learned by beginners..... T F
19. Weaving flat fiber around a stake is used wherever you cannot weave around a dowel.... T F
20. Whenever you weave around a stake with either round or flat fiber, a ¾-inch nail must be placed through the stake and weaver, after having wound the woven strand once around the end stake ..... T F
21. By winding the flat fiber once around the end stakes each time, will make the weaving get ahead of the winding on the stakes..... T F
22. The weaving of round fiber around a stake is begun the same as with flat fiber..... T F
23. The windings around the end stakes are the same with round and flat fiber..... T F

24. Whenever finishing a separate woven seat, the stakes should be fastened on the back of the seat dowel ..... T F
25. It is not necessary to trim off the surplus length of stakes closely to the nail heads when finishing T F
26. The weaving of fiber around the dowels strengthens the frame..... T F
27. The amount of windings around a dowel with round fiber is the same as around a stake..... T F
28. The ends of woven strands are usually nailed to the bottom or back of a dowel..... T F
29. On some projects the ends of woven strands are left behind the stakes ..... T F
30. The above rule applies where the ends are not so apt to be seen (on corners, bottom of seats).. T F
31. The rule of weaving flat fiber around a stake differs from that of weaving around a dowel.... T F
32. A veiling is used to give a decorative effect..... T F
33. Bumpers can be made of veilings..... T F
34. Four-strand veilings can also be made..... T F
35. After the stakes have been inserted into a project, a veiling usually follows it..... T F
36. Bumpers are used to prevent upholstered seats from sliding out in the front of rockers, chairs, etc. ..... T F
37. A type of "stake bumper" we learned will not tear the cushion at the front of seat..... T F
38. A skirt weave is put on a project to give it a balanced appearance..... T F
39. All skirt weaves have a straight edge..... T F
40. Skirt weaves are limited to use only on the front of projects ..... T F
41. The round fiber loops on a skirt weave are cut open ..... T F
42. With flat-fiber skirt weaves it is necessary to loop every stake..... T F
43. A border is usually made with the extra length of stakes when weaving is complete..... T F
44. A border also holds the weaving in place..... T F
45. Borders are usually fastened to the top or side dowels of a frame with ½-inch nails..... T F
46. "Over-two" borders can also be made when stakes are fastened single..... T F
47. An "over-two" and "under-one over-two" are also known as closed borders..... T F
48. Whenever a border is made completely around a project it can be begun anywhere..... T F
49. It is necessary to use an extra stake when beginning an "under-one over-two" border around a leg dowel..... T F
50. Whenever stakes are fastened in pairs, and you desire to make a double border, the first right-hand stake can be used for an "over-two" border, using the left-hand stake for an "under-one over-two" border ..... T F
51. When making borders above the seat, face the project from the front and begin the border from the left-hand side..... T F
52. To begin a border below the seat, face the direction the stakes are pointing, and begin from the left-hand side ..... T F
53. An overcasting is also known as a wire fitch.... T F
54. The twists between the stakes on an overcasting must correspond with those of a fitch..... T F
55. Overcastings can also be made with various diameters of fiber which give the project an artistic effect ..... T F
56. All fitching should be begun from the left-hand side ..... T F
57. The term "cross-fitching" means the crossing of stakes..... T F
58. The various cross-fitches derive their names from the number of stakes they cross..... T F
59. Tension should always be kept on the fitch with the left hand..... T F
60. In fitching the stakes are always selected with the left hand..... T F
61. During the process of fitching it is not necessary to place all the stakes into loops..... T F
62. Various effects can be obtained with combining straight and cross-fitches into a project..... T F
63. In fitching it is not necessary to space the stakes uniformly to correspond with the spacing of the weaving ..... T F
64. Fitching is also known as open work ..... T F
65. Fitching does away with the monotony of solid weaving ..... T F
66. In the "over-one and over-two" cross-fitch, you always skip a stake during the process of crossing the stakes..... T F
67. In fitching those stakes crossing to the left always remain in front of the stakes crossing to the right ..... T F
68. "Over-one and over-two" cross-fitches can also be made with stakes fastened in pairs..... T F
69. In an "over-four" cross-fitch the left stakes of the second and third pair remain vertical..... T F
70. The process fitching with triple stakes works splendidly on lamp shades and basketry..... T F
71. To fitch with triple stakes (straight and cross) between two posts, it is necessary to have a single stake in each corner followed by a pair of stakes on each side and the remainder nailed triple ..... T F
72. To make a "triple-stake cross-fitch" on a lamp shade they must be fastened triple completely around ..... T F
73. A diamond weave lends itself to wonderful decorative qualities in weaving ..... T F
74. A diamond weave can be made of round fiber only ..... T F
75. A diamond weave is a combination check and plain weave ..... T F
76. The term "diamond" refers to any number of woven checks when complete..... T F
77. In a check (of a diamond) made with five strands, the first, third, and fifth strands pass in back and over each consecutive stake..... T F
78. A check can be made either 3, 5, 7, or 9 strands high ..... T F
79. The 3- and 5-strand checks are most commonly used ..... T F
80. Check weaves are especially adapted to fern stands and baskets..... T F
81. An even number of strands is always required to a row of checks..... T F
82. The fan-back weave derived its name from a type of frame having a fan shape..... T F
83. A fan-back weave is a combination drop-off and plain weave..... T F
84. The term "drop-off" means looping the strand around each consecutive stake until complete... T F
85. On a fan-back the stakes spread out and act as the spokes of a fan..... T F
86. Regardless of the type of fan-back, all the stakes must be looped..... T F
87. A drop-off weave on a fan-back is somewhat similar to a roll weave..... T F
88. The vertical arrow-check weave adapts itself to narrow paneled backs of projects..... T F
89. The horizontal arrow-check weave adapts itself to fern stands..... T F

90. In a vertical check weave it is not necessary to have a single strand woven between each check ..... T F
91. An arrow-check weave is a combination half diamond with a row of single checks through the center ..... T F
92. The single strand between each check is also necessary on the horizontal arrow-check weave.. T F
93. A roll weave is usually placed on the top and side edges of tables, chairs, rockers and davenports ..... T F
94. On tables the roll weave is made completely around ..... T F
95. Whenever the roll weave is made on sides and top only, the strand can be woven around the end stakes or dowels..... T F
96. The herringbone-weave effect is produced by having a center stake with side stakes flaring to the left and right..... T F
97. The spaces between each adding of stakes on a herringbone weave should not be uniform.... T F
98. A herringbone weave is a combination plain and drop-off weave ..... T F
99. Artistic effects in checking can be obtained with the use of stakes..... T F
100. A diamond weave can also be improved by using stakes to make circles in the checks..... T F
101. Soft fiber can also be used to improve check and diamond weaves..... T F
102. A braid turndown is made somewhat similar to a braid, in which the stakes are turned down during the process of braiding..... T F
103. A braid turndown is adapted to a wide type of arm and to basket tops..... T F
104. A braid turndown on the left-hand arm is begun from the front..... T F
105. A braid turndown on the right-hand arm is begun from the top..... T F
106. (Braid turndown) Cut off the surplus ends of stakes flush with the bottom of the braid..... T F
107. All baskets have wooden bases..... T F
108. Basket designs are limited ..... T F
109. Baskets are easier to make without wooden forms T F
110. On baskets or other projects having a circumference, it is necessary to use an even number of stakes when doing plain weaving..... T F
111. It is necessary to have an even number of stakes to make a basket with a check weave throughout ..... T F
112. To begin a basket with a plain weave followed with a check weave, it is necessary to have an odd number of stakes..... T F
113. Tying knots is a process used in winding..... T F
114. Basket handles need not have a uniform shape.. T F
115. To make a stake border on a basket the stakes must be fastened single ..... T F
116. The stake border is best adapted to baskets without handles and on vases..... T F
117. The knots on basket handles need not be uniform T F
118. Keep an even tension on the strands when tying knots ..... T F
119. The old ends in tying knot handles for baskets should be trimmed off close to the knots..... T F
120. To make a loop border on baskets fasten the stakes in pairs..... T F
121. On a loop-stake border for baskets the stakes can cross either over one or two stakes..... T F
122. The loop-stake border can be turned down after adjustment to act as a flare or serve as the top of a basket..... T F
123. The knots on a basket handle should be twisted occasionally ..... T F
124. A six- or eight-strand "braid-turndown" is most commonly used ..... T F
125. The shaping of a roll weave is done by kinking the stakes with the fingers during the process of weaving until desired shape is obtained..... T F

Right:	.....	Score:	R.—W.
Wrong:	.....	Right:	.....
Omitted:	.....	Wrong:	.....
Total:	.....	Score:	.....

Problems and Projects

WROUGHT-IRON CURTAIN ROD AND HOOKS

H. M. Andersen, Cicero, Illinois

(See Supplement No. 303)

These are great days for the teacher of metal work. There is no limit to the projects that may be made of this material in the school shop. Especially numerous are the things that may be made for the home. The one described in this article is a curtain rod which is easily made and yet very attractive.

The rod itself is made of ½-in. square mild steel. The ends are heated and tapered down for a distance of 12 in. A small hook is then forged to the end of the taper, after which the tapered section is brought to a light-red heat. The small hook is then cooled in water, after which it is placed over the end of the form shown, and bent around the form until it fits snugly. The small hook may then be filed off. The twist in the center of the rod should be formed cold to insure uniformity. If the curtain rod is to be of such length that it will be difficult to work the ends, the scrolls may be made of short pieces and then welded to a long central piece.

The wall brackets are made of ⅛ by 2¼-in. band iron, and the hooks of ⅜-in. square iron. After the hook has been formed and the back of the wall bracket has been cut to shape, the two are welded together.

The rods and brackets should then be gone over with a file and emery cloth to remove most of the iron oxide. Use a preparation of beeswax, turpentine, and varnish applied to the slightly heated iron, as a finish.

LUBRICATION RECORD CARD

Fred C. Finsterbach, School 19, Buffalo, New York

The lubrication record card serves as a reminder and guide for the greasing and oiling of machines in somewhat the same manner as the auto lubrication chart serves the filling-station attendant.

It is hung on the machine in a container made of tinplate

or brass, and may be attended to by a student. The name of the machine is written at the top of the card together with the number of points for lubricating. The "special-instructions" space specifies the type of lubricant, the number of "shots" required, and other information of a nature to prevent *over*-lubrication as well as *under*-lubrication.

The student enters the date opposite the month, when he finishes the job. His shop number may be entered under "remarks" for check-up and credit.

OILING RECORD

for *Grinder*

2 Points for Lubrication

Month	Date	Remarks
Sept.		Fill Cups
Oct.		
Nov.		
Dec.		
Jan.		Fill Cups
Feb.		
Mar.		
April		
May		Fill Cups
June		

Special Instructions

1.- Turn grease cups monthly.

2.- Fill cups when specified or when empty.

A spot of bright-colored paint on each oil cup, etc., aids the student in finding the points for lubrication.

The card helps to emphasize the necessity for regular greasing. It also furnishes good training for the students as well as relieving the instructor from another of the countless routine jobs which cut into the actual teaching time.

BENDING FIXTURE FOR HACK-SAW FRAME

H. M. Andersen, Cicero, Illinois

To keep the hack saws in working condition in the school shop is a problem taking some time, and causing some expense. This expense may be reduced a great deal if the saws are constructed within the school. It has been the observation in our school shops that the short-legged hack-saw frames are preferred. They do not permit so much purchase, putting less tension on the back. The short legs prolong the life of the blade, for they transmit the thrust of the stroke to the back of the blade, instead of down on it.

The material used in making the frame is 3/16 by ¾ by 17-in. cold-rolled steel.

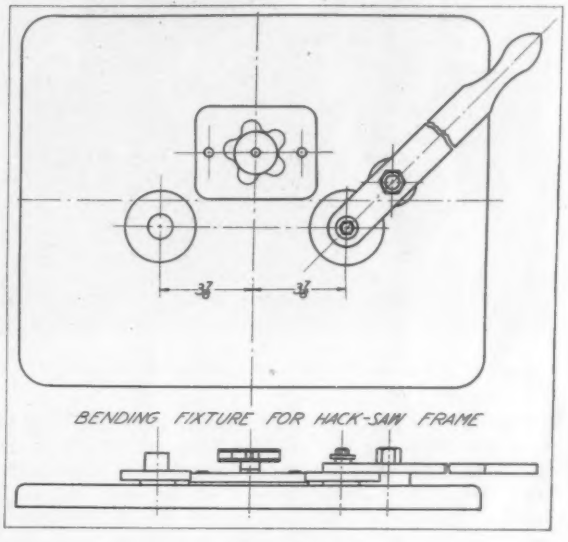


Fig. 1. Bending fixture

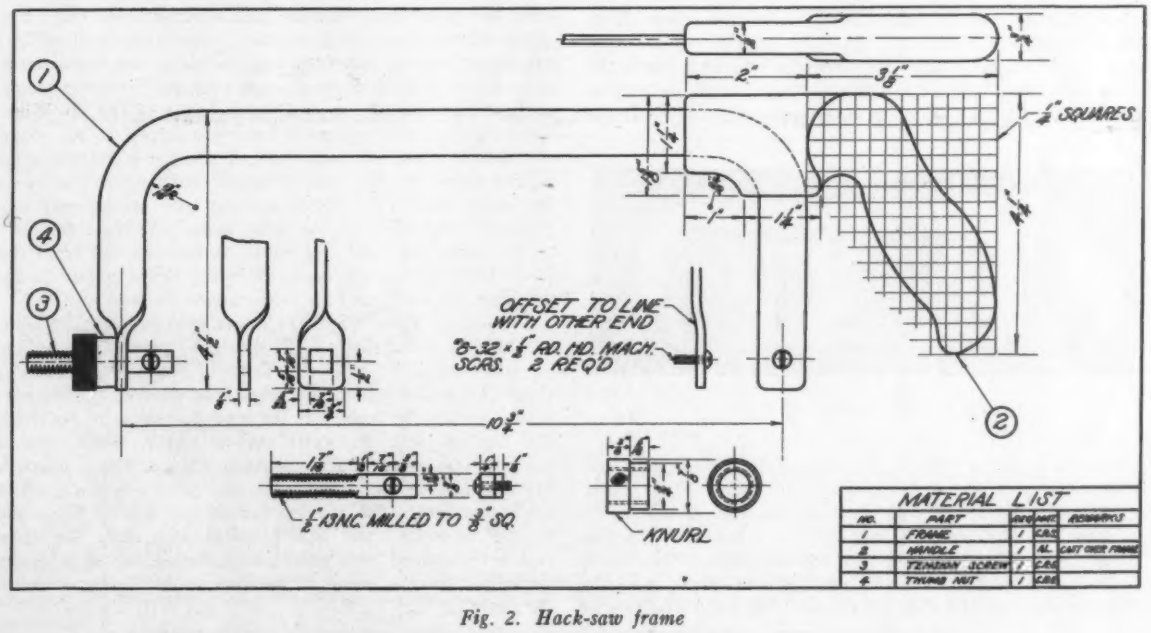


Fig. 2. Hack-saw frame

The frame shown in Figure 2 is made to take a 10-in. blade. In order that the frame be formed accurately, and all saws be alike, it is necessary first to construct a bending jig. This consists of the cast-iron plate shown in Figure 1, on which the bending fixtures are mounted. They consist of two centers around which the frame is formed, and one back clamp to hold the material in place and to prevent bowing of the back. The lever, which revolves about one of the centers, forms the frame. The two disks about which the frame is bent, and the back clamp, are undercut the thickness of the material, and the depth of the undercut is equal to the width of the stock. Therefore, looking at the end of the fixture there is a rectangular opening under the disks and the back clamp, which is 3/16 by ¾ in.

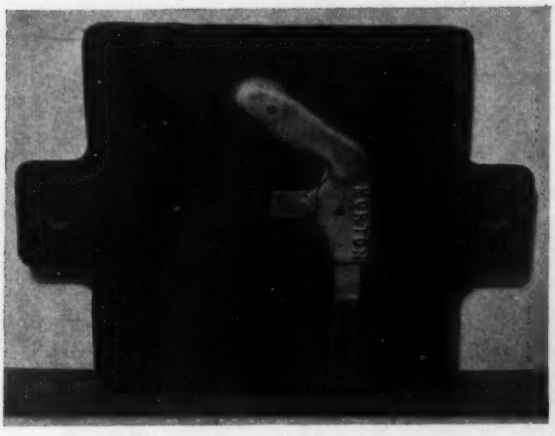


Fig. 3. Pattern for casting handle

The material out of which the hack-saw frame is to be made is heated near one end to a light red. Then it is slid under the disks and back clamp from the end opposite the lever. When the material projects at the lever end for a sufficient distance, set the back clamp with the hand screw and bend the end around the center with the lever. Then loosen the back clamp and slide the material from under the fixture in the direction toward the lever. After heating the other end, the material again is slid under the fixture from the end opposite the lever, and to a position so that the formed end comes under the center at the end where the stock is entering the fixture. In this position, the other end is formed. The back clamp is now removed, and the frame

Fig. 4. The finished hack saw

forced back off the centers. The benchwork is done next, and the first step is to cut both legs to the same length. Mark each end in the center, and ½ in. up for drilling. At one end a ⅜-in. hole is drilled, and at the other a 9/64-in. hole. The ⅜-in. hole is filed square to take the tension bolt. The 9/64-in. hole is tapped for a 8—32 machine screw. Next take the sharp corners off the ends with a file. The end to be twisted is heated, placed in a vise and given a quarter turn. Be sure to leave about ½ in. between the vise and the wrench for twisting.

The handle is cast of aluminum which may be salvaged from automobile parts. A split flask is used with a match plate (Fig. 3), for the purpose of casting the handle about the frame. The handle should require very little or no polishing if molded carefully. However, if it becomes necessary, use a coarse-cut file, and then finish with emery cloth.

The tension bolts are made of ⅜-in. round cold-rolled steel over which the die is run, and then the stock is milled square and cut into lengths. It has been found that a ⅜-in. wing nut is very satisfactory for putting tension on the blade.

After the student has completed the saw to this point, a hack-saw blade should be placed in the frame to check it for alignment.

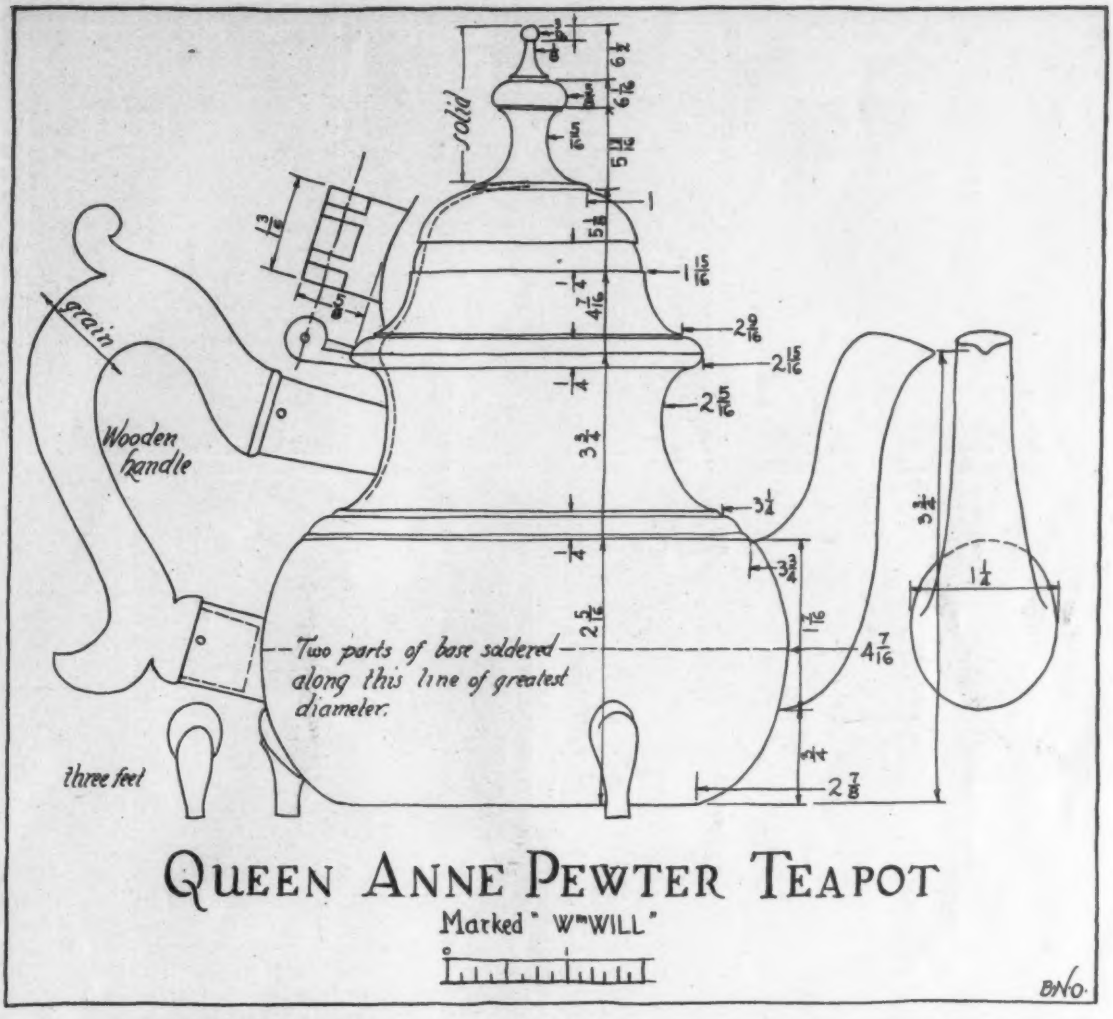
PAGES FROM A MUSEUM SKETCHBOOK

Burl N. Osburn, State Teachers College, Millersville, Pennsylvania

Queen Anne Teapot

This beautiful early teapot is one of the many treasures of Memorial Hall, in Philadelphia. The original was first cast, then probably put on the lathe for finishing. The one shown in the halftone is a copy made by a student, Mr. Howard Hausman. It is a rather difficult but valuable piece of workmanship. In the reproduction, the finial, the spout, the feet, and the hinges were cast in plaster. The handle sockets were rolled from flat strips and soldered. The lid and body were spun from 16-gauge pewter in three parts. As in the original, the bottom was made in two parts soldered together along the point of greatest diameter. The lower part of the body was spun on a simple one-piece form, and trimmed off squarely at the edge, to permit an accurate fit in soldering. The form for the upper part of the body was made in two parts; the large diameter (identical in diameter with the form for the lower half) was joined to the faceplate. A mortise, about 1 in. in diameter, was turned in the end. Into this was fitted the tenon on a piece which was to form that part of the body from the smallest diameter of the neck to the edge of the lip. When fitted together, this two-piece form was turned to the shape of the body above the lower half. A piece of metal was spun to this form and the base trimmed evenly to fit the piece previously made. The metal covering the narrow end was then cut away while on the lathe, permitting the small part to be drawn out, and the metal to be removed from the form. When accurately done, as in the reproduction shown, the joint between the two parts cannot be seen.

A solder of about 50-50 grade was used for the first joint, which, after being cleaned off, should be protected by filling the pot with sand. Six or eight holes of about ⅛-in. diameter should be drilled within the area to be covered by the base of the spout. The hinges in the reproduction were cut from the castings with a special milling cutter, which gave a straight, smooth edge. They could be cut out with a jeweler's saw and filed to shape. After the first joint was made, softer solder was used. The wooden handle was stained black and fit to the sockets and held in place with pins. The three feet were modeled from wood before casting. It was necessary to hollow out the inside of the foot to fit the curvature of the body.

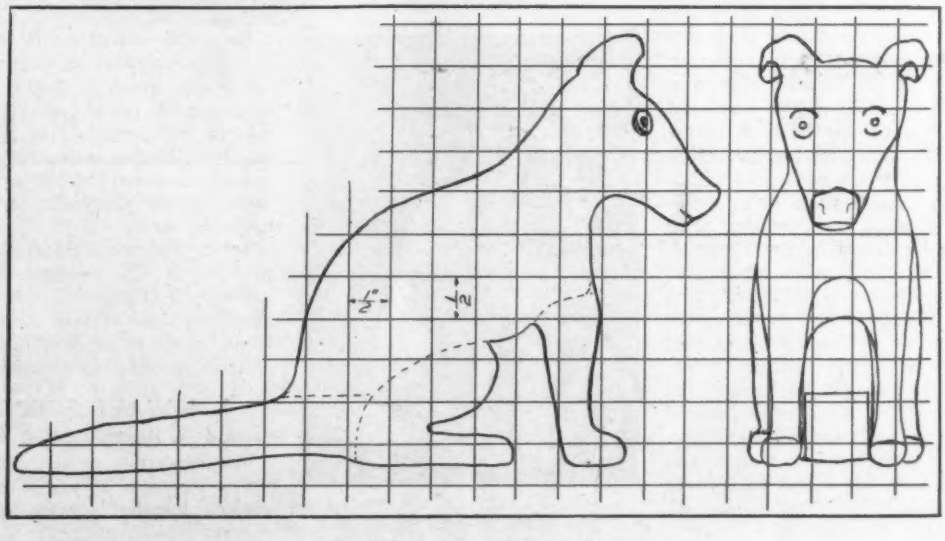


SPOTTY, THE PUP

D. C. Marshall, Manhattan, Kansas

The development of small machines for the school and home shops has opened up a field of construction much more varied than was possible with the larger machines of a few years ago. We all have made profile dogs for doorstops at some time or other; now it is possible to make dogs and other animals in miniature that resemble live ones. Spotty, the Pup doorstop, is an example of this type of work.

To make Spotty, take a block of wood of the proper size



Spotty's profile and front view

Fig. 2. The first step is sawing out the profile shape on the scroll or jig saw. Fig. 3. The body is rounded into shape by tilting it various ways and cutting off the corners. Fig. 4. By tilting the block, the wood can be sawed out from between the legs. Fig. 5. With a router bit in the drill press, Spotty acquires curves, gets his face lifted and receives a manicure. Fig. 6. With a dowel covered with sandpaper substituted for the router, Spotty has his "hair" trimmed

as shown in Figure 1 and draw the profile of the dog on one side, then saw it out on a scroll or jig saw. Then carefully saw out most of the hollows and curves on the same saw by turning the block around in many positions. See Figures 2, 3, and 4.

The rest of the shaping is done with a router bit in the drill press, or in a drill chuck on the wood lathe, running at as high a speed as possible. See Figure 5. Then, holding Spotty in the hand, take light cuts here and there, thus giving him a manicure, lifting his face, putting curves on his figure at the proper places, and taking them off in other places.

When he is fully shaped, remove the router and substitute a small dowel around which a piece of sandpaper has been glued. Spotty then gets his first haircut and shave, and comes out in that immaculate condition in which every well-trained dog loves to appear. See Figure 6.

Spotty, the Pup

He is still without a tail, however, and so a piece of wood ¾ in. square and of the proper length is needed. It, too, is shaped on the saw and sand spindle, leaving one end square. Now cut a square notch in the dog to fit this square end, and glue and nail the tail in place. Then touch up the joint with the sander to make the curve.

Spotty is then ready for painting, which may be in any combination of spots desired. All of the boys will want a dog after they see the first one, and it will be no trouble to get them to design other patterns for other kinds of dogs.

A WALL SCONCE

Gerald A. Boate, Seattle, Washington

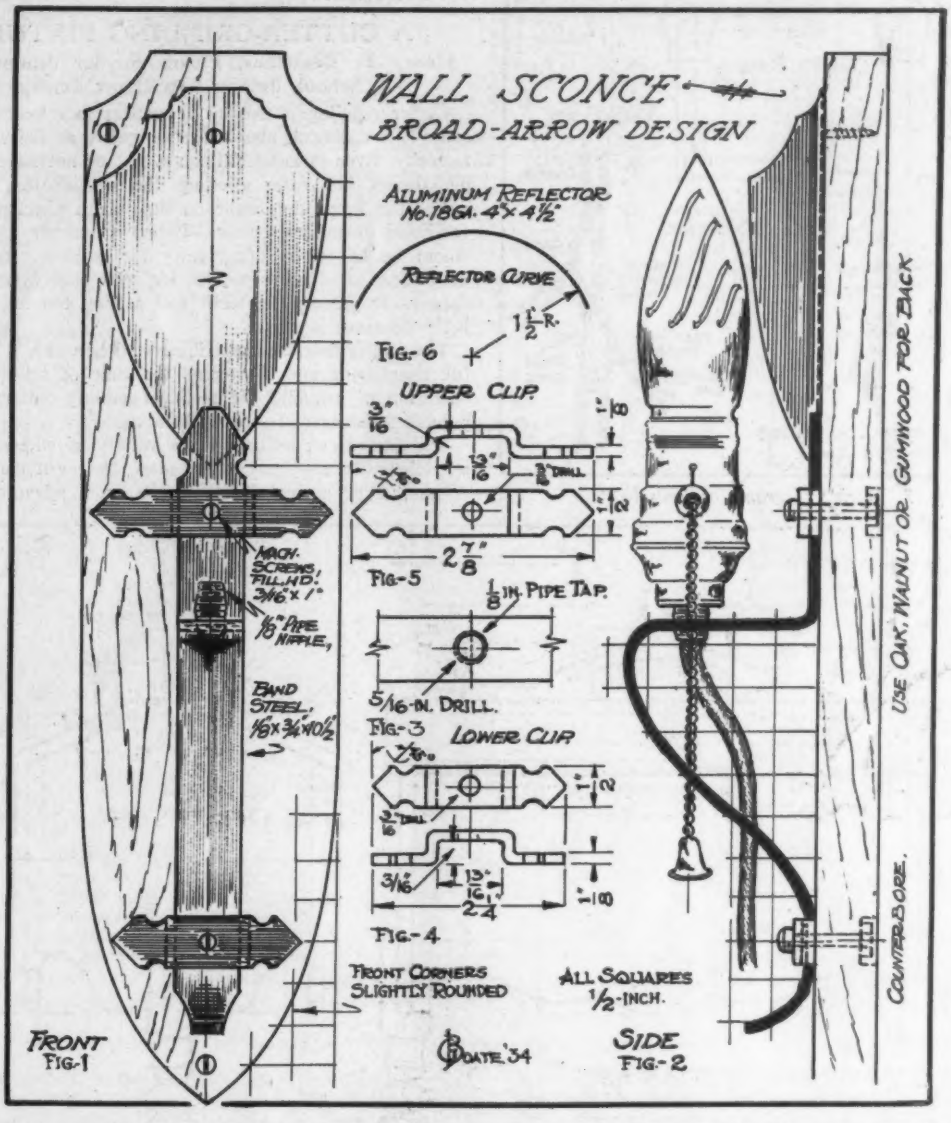
The conversion of scrap into projects which appeal, is always interesting. The project described herewith is made of material which, other than a ⅛-in. close

iron nipple, a chain-pull electric-light socket, candelabrum-type bulb, and a few nuts and bolts, consists mostly of scrap.

The motif of the design dates back to the cross-bow era. The design is harmonious, since all of the parts follow the same general outline of arrow point and shield. The project is very simple but requires careful workmanship in wood, iron, and electricity.

The upper and lower clips are next bent to shape after which their ends are sheared and filed to the shape of the broad arrow point. The semicircular notches are filed in with a rat-tail file. For fastening the clips to the back, use 3/16 by 1-in. fillister-head machine screws and nuts. The respective holes in the clips, light arm, and back must be in alignment.

The back of the board is counterbored to permit the nuts



Oak, walnut, or gumwood may be used for the back. A piece ¾ by 3⅛ by 12¼ in. is required. The edges should be rounded lightly and the wood sanded smooth. The finish consists of several rubbed coats of linseed oil and white shellac, carrying the process to a satin finish.

The reflector may be made of tin or sheet aluminum cut to the shape shown in Figure 1. If sheet aluminum is used, it may be peened carefully with a ball-peen hammer. The reflector is bent to the shape shown in Figure 6 and attached to the back with small flat-head nickel plated wood screws. The bottom end is held in place by the top of the light bracket.

The light arm is made of ⅛ by ¾ by 10½-in. band iron bent to the shape shown in Figure 2. Figure 3 shows where to tap the arm for the ⅛-in. close iron nipple to which the standard chain-pull brass socket is fastened.

to be pocketed in the back. Before the final tightening is done, the iron part should be removed from the back and scrubbed to a bright surface with emery cloth, then wiped off, using a cloth saturated with brushing-lacquer thinner. A finish in keeping with the design is flat black lacquer. The light bulb should be the conspicuous part, and not the sconce. When the lacquer is dry, the metal parts should be attached to the wood back, making sure that the clips are square with the light arm. Use a clean cloth and keep your hands off the back board as much as possible.

The back may be covered with some inconspicuous colored material such as leather, felt, or heavy flannel. This material should be glued to the back using iron glue which, if used as directed on the bottle, will make a nonpeeling connection.

When fully assembled, the sconce is fastened to the wall with three long, slim, flat- or round-headed blued wood screws.

If this sconce is to be used in pairs, the wiring may be done as shown in Figure 7.

The selection of the candle bulb should receive some attention as to shape and color of the glass as well as wattage.

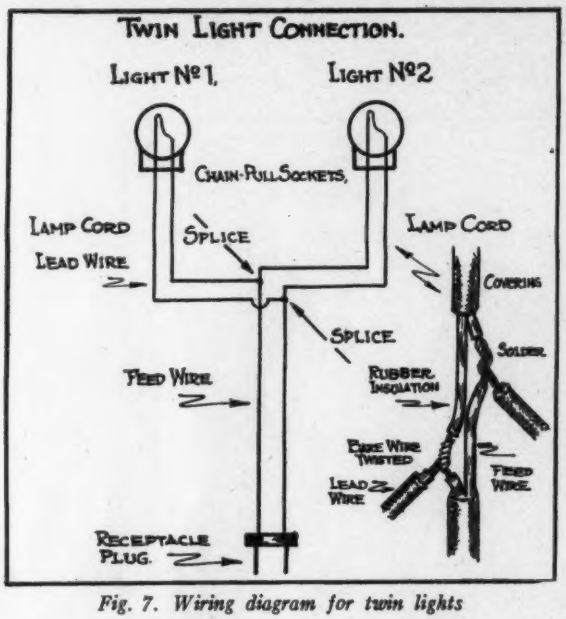


Fig. 7. Wiring diagram for twin lights

If the sconce is to be used only as an ornament, select a 10-watt bulb. This would be suitable, for instance, for lighting the side of a fireplace or the wall of a sleeping room or a den. On the other hand, if it is to be used at the side of a dresser, it should be 25 or 40 watts. The wiring may be made quite inconspicuous if a properly colored extension cord is chosen, and if it is made to follow the intersection between floor and wall, or between one wall and an adjacent wall, to the most convenient outlet.

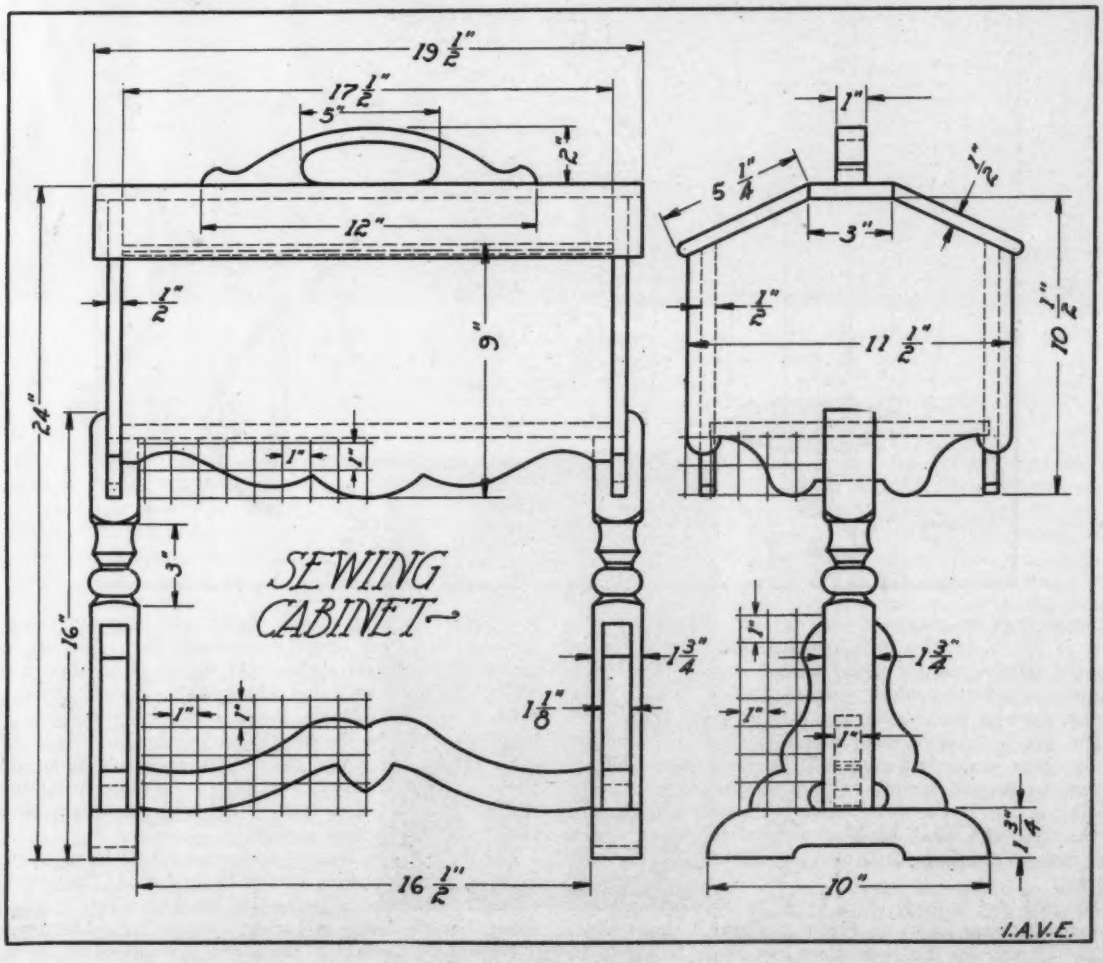
A CUTTER-GRINDING FIXTURE

Henry P. Boettcher, Henry Snyder Junior High School, Jersey City, New Jersey

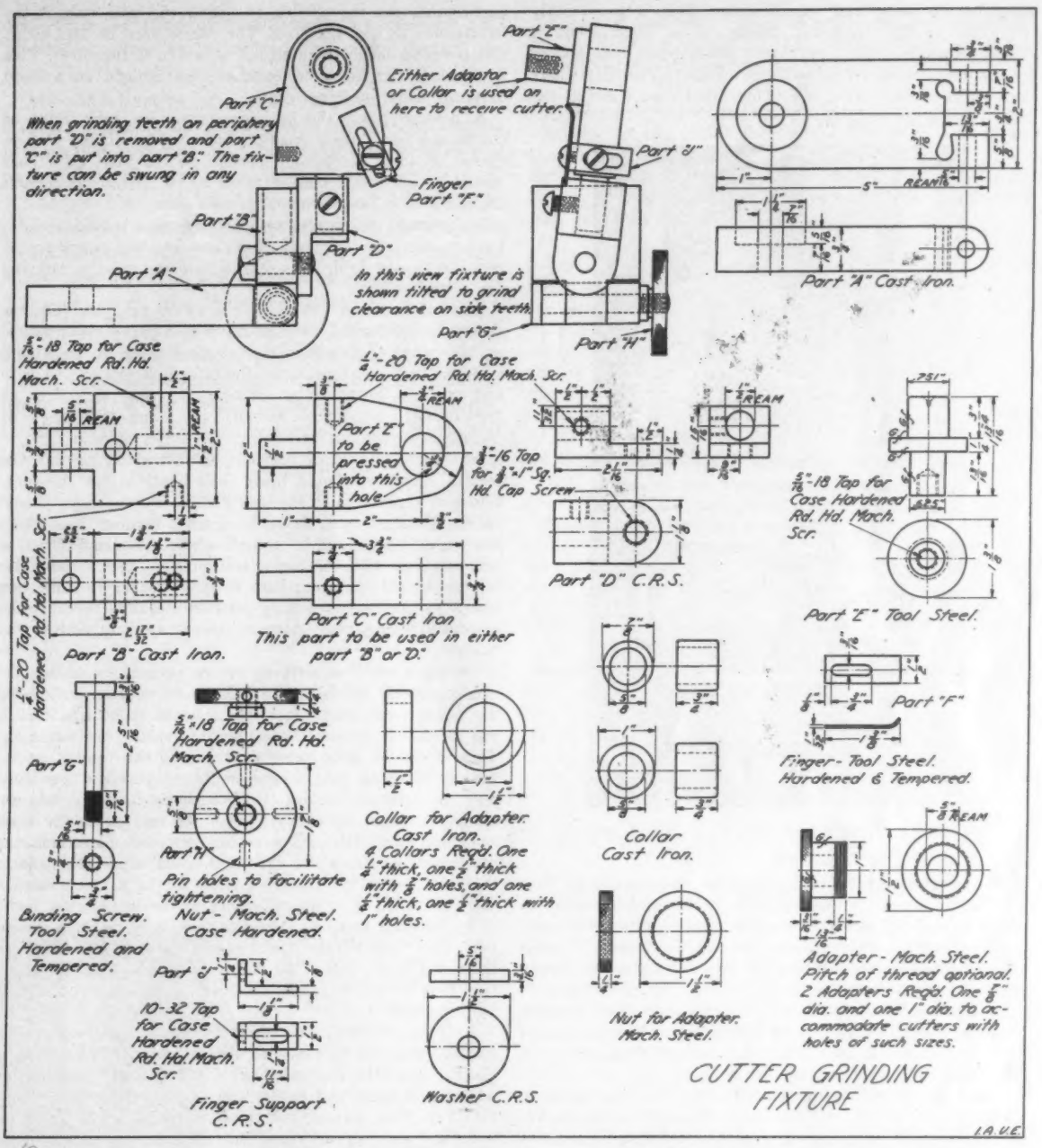
Cutter grinding is usually a bugbear in school shops because it is a difficult matter for a pupil to do the work satisfactorily. Even in industrial shops that do not have a special department for cutter grinding, the job is often neglected unless the foreman is right on the job to check up on the condition of milling cutters. Unless a teacher has a pupil whom he has given opportunity for practice, the chances of getting satisfactory results are slim, and even then the danger of burning the teeth and getting too much or too little clearance is great.

The fixture described and illustrated herewith is very useful, simplifying and shortening the time of set-up and the operation of grinding the teeth of milling cutters. It also reduces the danger of error in grinding.

The fixture can be used for a variety of cutters, such as straddle mills, angular cutters, saws, and even plain milling cutters, if of narrow face, etc. Its main advantage is for



Floyd D. King, Phoenix, Arizona


When grinding teeth on periphery part "D" is removed and part "C" is put into part "B". The fixture can be swung in any direction.
Part "C"
Either Adaptor or Collar is used on here to receive cutter.
Part "E"
Part "J"
Finger Part "F."
Part "B"
Part "D"
Part "A"
In this view fixture is shown tilted to grind clearance on side teeth.
Part "G"
Part "H"
Part "A" Cast Iron.
5/16"-18 Tap for Case Hardened Rd. Hd. Mach. Scr.
1/4"-20 Tap for Case Hardened Rd. Hd. Mach. Scr.
Part "E" to be pressed into this hole
3/8"-16 Tap for 3/8"-1" Sq. Hd. Cap Screw
Part "D" C.R.S.
5/16"-18 Tap for Case Hardened Rd. Hd. Mach. Scr.
Part "E" Tool Steel.
1/4"-20 Tap for Case Hardened Rd. Hd. Mach. Scr.
Part "B" Cast Iron.
Part "C" Cast Iron
This part to be used in either part "B" or "D."
Part "F"
Finger - Tool Steel. Hardened & Tempered.
5/16"-18 Tap for Case Hardened Rd. Hd. Mach. Scr.
Part "G"
Part "H"
Collar for Adapter. Cast Iron.
4 Collars Req'd. One 1/4" thick, one 1/2" thick with 5/8" holes, and one 1/4" thick, one 1/2" thick with 1" holes.
Collar Cast Iron.
Pin holes to facilitate tightening.
Nut - Mach. Steel. Case Hardened.
Binding Screw. Tool Steel. Hardened and Tempered.
Part "J"
10-32 Tap for Case Hardened Rd. Hd. Mach. Scr.
Finger Support C.R.S.
Washer C.R.S.
Nut for Adapter. Mach. Steel.
Adapter - Mach. Steel. Pitch of thread optional. 2 Adapters Req'd. One 7/8" dia. and one 1" dia. to accommodate cutters with holes of such sizes.
CUTTER GRINDING FIXTURE
I.A.V.E.

grinding the teeth of angular cutters and side milling cutters. It can be used also to grind faces of gear cutters and circular saws.

For grinding clearance on plain milling cutters, especially of long face, the shell arbor which slides over mandrel held between centers is more useful.

The fixture may be made of salvaged material if possible. Changes could be made in its shape and style, but the principle is the thing which makes it valuable.

To use this fixture, it is necessary to remove the upper part of the vise which comes with the Norton Universal grinding machine, and fasten it with the same screw to the base on which the Norton vise swivels. It fits right over the lug of the base. However, the fixture can be held in any other manner — on the table of the grinding machine or in the vise of the machine. It can be swung to any angle, in any direction necessary to do the desired grinding. The finger on which the cutter tooth rests is adjustable.

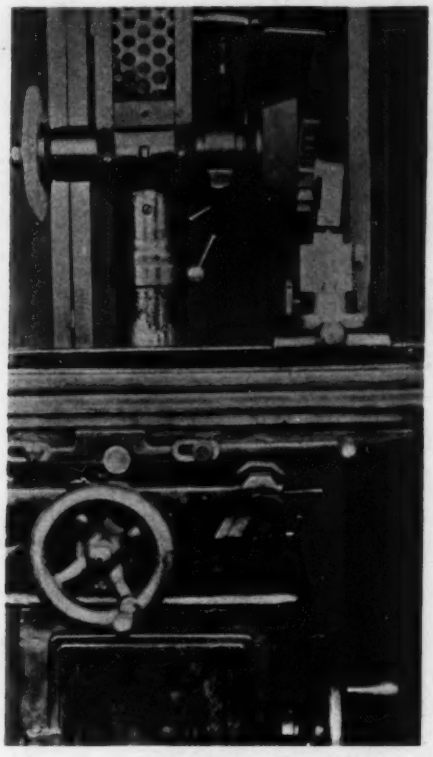
MODEL YACHT REGATTAS

Claude William Horst, Vocational School, Milwaukee, Wisconsin

Along with a wide variety of other hobby clubs, the model yacht club is an extracurricular activity which is a stimulation to a better use of leisure time. As a motivation for the development of skill in the handling of woodworking tools, it has much value. It should always be the aim of the club to use only authentic designs and drawings, and to become familiar with the fundamentals of ship and model construction, and nomenclature, with power plants and sail combinations, and certain phases of seamanship in general.

A regatta held near the close of the school year is an opportunity to pit one's model against those of the rest of the group or of other groups, and satisfies the boys' desire for competition. The objective of the regatta should not be merely to select the fastest boat, but to reward accurate, careful workmanship, and the ability to construct a yacht

according to plans and specifications. This is particularly important in the motorboat classes, as in them speed is largely determined by a purchased power plant, and seldom by the boy's work. With sailboats of the same size, where cost enters in very little, it is more fair to use speed as the chief criteria for judging.



The cutter-grinding fixture described on pages 26 and 27 set up for use

The schools themselves may sponsor the regatta if they care to, or it may be sponsored by the local park board, the playground department, a newspaper, or a city yacht club.

The site of the course should be carefully chosen. A small lake or a pond is probably most desirable for power boats, especially if it is protected from the wind, as power boats do best on smooth water. Sailboats need water that is more open so that the wind will be unobstructed. For this reason the two do not usually make a good combination at the same regatta.

It is desirable to have plenty of room for spectators to view the full length of the course. Whenever large crowds are expected it is well to make provision ahead of time for handling them. Boy scouts, school police, park police, or other groups are variously used for this purpose. A lane should be roped off along the water's edge to permit the participants and the officials to follow the race without the interference of the spectators. The course must be kept clear, and someone should be assigned to see to it that it is. This is especially important when the event is held on a body of water used by larger craft.

A definite place should be reserved for each class of contestants and their boats. Each group should be in charge of some responsible person. In the race, each boat should be allowed a lane of from 10 to 20 feet to prevent the boats from interfering with each other.

The starter, the announcer, and the judges should be carefully chosen. They should have had enough experience in their particular field to assure a smooth, orderly carrying out of the program.

Some time before the regatta is to be held, the program should be announced, through the school paper for instance, or by means of a mimeographed sheet given to each club member. It should contain the following information: (*a*) size and types of boats to be entered; (*b*) time and place of registration; (*c*) prizes offered; (*d*) time and place of preliminary races for each type; (*e*) order of final races.

At least two weeks previous to the date set for the regatta, the boys should bring their boats in for classification and registration. Only boats made by the boys should be eligible. Each boat should be given a number. For school use, only length need be considered in the classification of sailboats, but with the motor boats, power plants must also be taken into consideration. It is advisable to have the groups as evenly matched as possible. Regattas are likely to be short anyway and more groups really only add to the interest.

Getting a power boat ready for racing includes setting the rudder so that the boat will hold to its course, and testing the power plant, particularly for distance to be sure that it will finish the course. A number of tryouts are advisable. This should be done some days before the regatta, as no testing or trying out is permitted on the course any time near the hour of the regatta. Frequently many tryouts are necessary to get sailboats ready for the race, especially when a sliding mast plate has not been provided. Sometimes the mast must be moved or even a new sail made, to strike a balance between the center of effort of the sail combination and the center of lateral resistance of the under-water body. If an authentic design is chosen to begin with, and it is carried out in every detail, the model should sail properly with very little adjusting. When the boats have been put in sailing trim they should be placed on their stands and not disturbed until the race.

It is usually better to judge the boats for workmanship and for accuracy in following the design, after the races, as there is more or less handling of the models in connection with the judging, and rudder and sail adjustments are likely to suffer. First, second, and third prizes for speed, for workmanship, and for accuracy in following the design make possible a more widely distributed recognition of the boys' efforts. The prizes need not be costly, as even ribbons are valued by the boys.

Drop Forging

G. H. Snaddon

Central High School,
Detroit, Michigan

A related-subjects lesson well suited to any metal-working or machine-shop course.

METALS shaped by being heated in furnaces and afterward pounded between dies by power drop hammers are known as *drop forgings.*

The present-day art of drop-forging metals by mass-production methods has practically replaced the hand methods used by the medieval smithy. The smith is still a mighty man, but he no longer works with hand tools under a spreading chestnut tree. The modern forge shop utilizes powerful machinery and reverber-

ates with the thud of steam hammers and the roar of heating furnaces rather than with the ring of the anvil and the hum of the hand bellows.

The direct-acting steam hammer which has contributed much to the development of the drop-forging process was invented by James Nasmyth in 1839 and patented by him five years later.

The first Nasmyth hammer was erected at the Bridgeport Foundry near Manchester, England, in 1843. The steam hammer ranks as one of the most important mechanical and economic inventions of all time.

Forging with drop hammers began in the United States about 1853 when Samuel Colt adopted these machines to the making of parts for firearms.

A steam hammer of great size was erected at Bethlehem Steel Works, South Bethlehem, Pennsylvania, in 1889, having been used for forging armor plates and other large steel objects.

Drop-Forging Dies

There are several different types of drop-forging dies now in use. The simplest type is the one-impression die. It consists of an upper and lower die block with a single recess or impression cut into it. Forgings that can be produced in one-impression dies are limited to uniform shapes which do not vary greatly in width, thickness, or diameter at different cross sections.

Two impression dies are in general use: One is used for forming or roughing the forging, the other for finishing it. On small and medium-sized forgings the two impressions are placed adjacent to each other in the same die block. In the production of large forgings, the finishing impression is often made in a separate set of die blocks, then fitted in another hammer which is usually located conveniently near the one which does the forming. The forger utilizes both hammers in such cases to complete the work. This two-operation principle is used with other types of dies besides the two-impression type.

1. *Chrome-Molybdenum Steel ⅜ by 1¼ by 7 in.*
2. *After the "breakdown."*
3. *Wrench fully forged.*
4. *"Fin" removed.*
5. *Complete rough wrench.*
6. *Finished wrench — milled, heat-treated, and chrome plated.*

Courtesy of Williams Drop Forge Co., Buffalo, N. Y.

Dies for difficult forgings may need as many as four impressions in them. They are commonly called (1) the anvil or fuller, (2) the breakdown, (3) the roughing impression, (4) the finishing impression. The impression known as the fuller generally is used to draw out the metal. It is usually located at the left side of the die. This drawing-out operation is necessary in making forgings in which there is considerable displacement of the metal, such as occurs, for example, in the forging of a double-ended wrench varying considerably in width and thickness at different cross sections.

It is often necessary to distribute the metal by bending and otherwise forming it into rough outline preliminary to finishing it. This is done in the breakdown which, as a rule, is located on the right-hand side of the die for the convenience of the forger.

After being roughed to shape in the fuller and breakdown, forgings are generally formed to nearly finished dimensions in the roughing impression, then several blows are struck in the final finishing impression.

Cut-off

Cold-trimmed forgings usually are severed from the bars while hot by the use of a cut-off or side shear. The chisel-shaped projections forming the cut-off may be milled into the die blocks or made of separate pieces, then set into them, so that they may be readily replaced in case of excessive wear or breakage.

Gate and Sprue

The original bars used in making forgings are often thinned down where they connect with the forgings. The channel in the dies that shapes this connection is known as the *gate*. Each impression has a gate extending from the edge of the die block to the front end of the impression. The size of the gate is determined by the weight of the forging, since it has to support it while it is being forged.

The gate is enlarged at the edge of the die block to form an opening large enough to admit the rough bar. This opening is called the *sprue*.

Trimming Dies

In addition to the varying types of drop-forging dies in daily use, there are dies for trimming the *fin* from forgings either while they are hot, or after they have cooled, depending upon their size and shape. Small forgings, as a rule, are cold-trimmed, after being forged, while large ones are hot-trimmed during forging. Either hot- or cold-trimming dies may be made solid or in sections, as seems most practicable.

Metals Used for Dies

Drop-forging dies are made from steel, steel castings, and cast iron. High-grade open-hearth steel, of 0.60 to 0.90 per cent carbon content is generally used. Alloy steels, such as chrome nickel, vanadium, and tungsten are now being used for die blocks. The steel from which die blocks are made is generally obtained from the rolling mills in bars.

Cold-trimming dies are made from high-carbon steel then hardened; hot-trimming dies are made from a special grade of steel known as hot-trimming die stock.

Laying Out and Shaping Dies

In laying out die blocks, the faces are first covered with copper sulphate, or blue vitrol; secondly, the outlines of the impressions are carefully located and marked by scribing and center punching. These outlines are used as guides when machining the impressions. Various machine tools are used in the machining operations. Those most frequently used are planers, shapers, lathes, milling machines, grinders, drill presses, also die sinking and profiling machines of various sizes and types.

The most difficult work of die sinking is the handwork necessary to finish the corners and irregular shapes existing in many die designs. These surfaces must be chipped, scraped, riffled, and polished by hand processes, in order that the forgings may come out of the dies easily, and so that smooth-surfaced forgings will be produced. The die blocks are held in a ball vise while this handwork is being done.

Lettering

Raised lettering on forgings is produced by stamping the dies at the bottom of the impression with deep flat-faced letters.

Taking Lead Proofs

It is customary to take a lead proof from the dies after they have been completed and preliminary to their use in order to ascertain how the forgings will look when completed, to check shrinkage allowances, and to determine whether or not defects exist in the impressions. In taking the lead proof, the impressions in both upper and lower dies are cleaned out and dusted with powdered chalk; the dies then are clamped together and molten lead is poured in. After the lead has cooled, the dies are unclamped and the proof removed for examination. If the dies are unsatisfactory for any reason, the necessary changes are made and another lead impression taken.

Fin and Flash

Theoretically, the amount of metal forged into the dies should just fill the impressions, but this idea does not work out exactly in practice due to several uncontrollable factors. There is always some extra stock to be disposed of after the impressions are completely filled. This excess stock that is squeezed out is called *fin*. To provide for this fin, the finishing impressions in the die are recessed all around for a depth and width varying according to the size of the dies. This recess or groove is known as *flash*.

Shrinkage, Draft, Finish Allowance

The extent to which metals contract and expand when heated must be considered in sinking dies for drop-forging purposes. The impressions in the die blocks are, therefore, made larger than the finished size of the forging. This allowance for shrinkage on small cold-trimmed steel forgings is, in general, 3/16 in. to the foot; on hot-trimmed steel forgings it is ⅛ in. to the foot. These allowances remain practically the same on forgings made from wrought iron, copper, bronze, or aluminum.

The sides of die impressions are not made perfectly straight but taper, or slant, away from the vertical so that the forgings will not stick in the dies. This taper is technically known as draft. The amount of draft varies from 3 to 10 degrees.

Finish allowance, as in the molding process, is the additional metal added to surfaces that are to be machined. This varies from 1/16 to ⅛ in. on large forgings, such as crankshafts. On small pieces, requiring only grinding and polishing, about 1/100 of an inch is allowed.

Heat Treatment

Drop-forging dies usually are heat treated before being used. Most modern drop-forging plants have facilities for the hardening, annealing, casehardening, and general heat treating of dies. Forgings made from high-carbon and alloy steels usually require annealing before they can be machined.

Hardening and annealing temperatures that used to be determined by the skill and judgment of the heat treater, a few years ago, are now measured with extreme accuracy by means of pyrometers, or heat-recording instruments, which are attached to oil-burning automatic furnaces. The work of the heat-treating department usually is directed by a highly trained technical staff of expert metallurgists.

Power Hammers

Most drop-forging plants and departments are equipped with forging machines, forging presses, trip hammers, electric-welding machines, power shears, trimming presses, upsetting machines, etc. The types of power hammers in general use are the board drop hammers from 300 to 3,000 pounds, the steam drop hammers from 2,500 to 12,000 pounds, and the steam hammers.

After they are completed, the drop-forging dies described above are fitted to one or another of these types of hammers. In general, the upper die block is attached to a ram which moves vertically between two uprights. These uprights are attached to a ram which moves vertically between two uprights. These uprights are attached to a stationary base which holds the lower die. The length of the stroke of the ram, the force of the blow it delivers, and the action of the hammer in general are regulated automatically by adjusting the throttle-controlling mechanism and the position of a foot treadle, which in turn regulates the steam flow.

Operations in Producing Drop Forgings

1. *Heating.* Metal bars are heated to the correct forging temperature in oil, gas, or other types of industrial heating furnaces which are usually located near the steam driver hammers for the convenience of the forger. Several bars are usually heated simultaneously so that one will always be at the proper forging heat when needed.

2. *Forging.* After removing the heated metal from the furnace with tongs, the heater passes it to the forger who starts the steam hammer in motion by a foot treadle, then places the hot metal in the fuller. He next changes it quickly to the breakdown for a series of blows, then to the roughing impressions, then finally to the finishing impression. The forgings are thus gradually shaped to their final form. These consecutive operations are performed while the hammer is in continuous motion. This necessitates considerable skill, speed, and judgment on the part of the forger. This description is typical of the production of forgings by the use of four-impression dies although other forgings are produced in the same manner except that fewer operations may be necessary.

3. *Trimming and Cutting Off.* The surplus metal, or fin, is next trimmed from the forgings in trimming presses equipped with trimming dies. Forgings that are to be cold-trimmed are first allowed to cool off, while those of such size and shape that can be hot-trimmed best are trimmed at the same time as they are forged so that they can be completed in one heat. The trimming press is located near the steam hammer for convenience, in such cases, and is, as a rule, provided with a cut-off to shear the forgings from the end of the bars of metal from which they have been made.

4. *Transportation.* In up-to-date forging plants many modern conveniences are employed to aid in the economical movement of forgings and raw materials to the various departments during the process of manufacture. The wheelbarrow and hand truck have been replaced by locomotive crane, electric traveling crane, electric lift trucks, gasoline tractors, and the like.

5. *Machining.* Forgings that require machining are sometimes pickled in dilute sulphuric acid or tumbled in rattlers, to remove the scale, or hard outer surface, formed during the forging operations. Following this preliminary treatment they may be machined to precision limits, then sent to the assembly department for final assembly.

String Drop Forging

String forging is an economical and rapid method of producing small-sized forgings. By this method several small pieces are forged in a row or string on the same bar of metal in one heat. The time ordinarily spent in handling each piece separately is thus saved in both the forging and trimming operations.

Testing Laboratories

Chemical and physical testing laboratories are extremely important departments in some drop-forging establishments. The raw materials, or steel bars, used in manufacturing drop forgings are sometimes analyzed chemically to check their uniformity and to determine whether or not they meet the desired chemical specifications. The physical laboratory tests forgings while they are being made and after they are completed. These tests consist of static tests for ultimate strength, elastic limit, elongation, etc.; dynamic tests, such as the vibratory test; the microscopic examination, to detect the exact degree that heat treatment has developed the microscopic constituents of the steel. The quality of the drop forgings produced is thus scientifically controlled and maintained.

Examples of Drop Forging

Drop forgings are used in large quantities for a wide variety of purposes. Space will not permit listing all the present-day conveniences for which these forgings are used. Only a few of the most important will be given. They include parts for adding machines, airplanes, automobiles, bicycles, cooking ranges, elevators, golf irons, jewelers' tools, lawn mowers, locks, sewing machines, shoe machinery, typewriters, automatic sprinklers, metal window sash, printing presses, telephone and telegraph appliances, and woodworking machinery.

Some typical illustrations of the process are: Adjustable and solid wrenches, connecting rods, camshafts, crankshafts, valve stems, tool posts, eyebolts, handles, thumb screws, "C" lamps, strap clamps, lathe dogs, knurling-tool holders, nail pullers, staple pullers, ball-peen hammers, steel chains.

Qualifications for Drop Forger and Die Sinker

In general, the drop forger should understand the setting up, the adjusting, and the general operation and care of dies and forging hammers of various kinds. He should be familiar with the characteristics and properties of metals and with the best working temperatures required for forging different grades of iron, steel, and other metals. A knowledge of the operation of industrial heating furnaces of various kinds is essential. He must possess the ability to handle hot metal under a steam or drop hammer skillfully and quickly. Experience equivalent to an apprenticeship in a drop-forging plant or department is a prerequisite. Good physical strength, ability to endure heat and to direct the work of firemen, heaters, helpers, and the like, are other necessary qualifications.

The die sinker, in general, must possess the special ability and skill necessary to lay out die blocks accurately, to make and use templates, to read and interpret blue prints, and to operate efficiently the various special and standard machine and hand tools ordinarily used in die sinking. Other necessary qualifications are accuracy, speed, adaptability, good eyesight, and good health. As a rule, the die sinker for drop-forging dies is a journeyman machinist or toolmaker, who has specialized in the making of such dies. Before becoming a qualified journeyman, he has probably served a four-year apprenticeship, or its equivalent, in general toolroom work.

References

The New International Encyclopedia, Dodd, Mead and Company, New York, N. Y.

International Library of Technology, The International Textbook Co., Scranton, Pa.

Machinery Encyclopedia, The Industrial Press, New York, N. Y.

Drop Forging, Die Sinking, and Machine Forming of Steel, by J. V. Woodworth; N. W. Henley Publishing Co., New York, N. Y.

Design of Drop Forging Dies, McGraw-Hill Book Co., New York, N. Y.

Questions

(For class discussions, written reports, further investigation and study)

1. (*a*) What are drop-forging dies? (*b*) What are trimming dies?

2. (*a*) What are some of the metals used in die construction? (*b*) Distinguish between carbon and alloy steel.

3. (*a*) Why are the operations of chipping, scraping, riffling, and polishing of dies necessary? (*b*) What does riffling mean? (*c*) What are rifflers?

4. What do you understand by the following terms: Breakdown, anvil, cut-off, gate, sprue, fin, flash, contraction and expansion of metals, draft, recessed, precision limits, scale, pyrometer?

5. Distinguish between hardening, tempering, annealing, and casehardening of steel.

6. Why is it necessary to take a lead impression or proof of finished die blocks before using them for forging purposes?

7. Explain the necessity for shrinkage, draft, and finish on drop-forging dies.

8. (*a*) What is a board drop hammer? (*b*) A steam drop hammer?

9. Explain clearly how a drop forging is produced.

10. What is string drop forging? What are its advantages?

11. Name twelve common drop-forged articles in daily use not given in the previous list.

12. Give the essential qualifications for (*a*) drop forger, (*b*) die sinker.

13. (*a*) What is a metallurgist? (*b*) What qualifications are necessary to be one?

14. Write a paper of five hundred words or more on any one of the following topics:

(*a*) A Historical Sketch of the Development of the Drop-Forging Process.

(*b*) What is the Force of a Blow?

(*c*) The Making of Drop-Forging Dies and Trimming Dies.

(*d*) Kinds and Types of Drop-Forging Hammers in General Use.

(*e*) Industrial Heating Furnaces for Drop Forging.

Some Questions Answered

REPAIRING BLISTERED VENEERS

922. Q.: I have a built-up veneered-top table with an intricate design worked up in the veneer. This design was built up on paper and glued to a panel of plywood, and used as a card-table top. The paper was removed, after the gluing process, and with the exception of a very few blisters, which were ironed out, the top seemed to be a very good job. Then the table was shellacked, varnished, and rubbed. Since that time many blisters have appeared, some of them measuring several inches across. Is there any way in which I can save this veneered top? The veneer is 1/26 in. in thickness. — *H.L.W.*

A.: The problem of your blistered veneer is not so serious after all. You will need, first, hot cabinetmakers' glue of a consistency that when the fingers are dipped into the hot glue and then separated slowly, the resulting glue bridge breaks at 5/16 in. Next, a new safety-razor blade of the Gem type with a bar across the top edge. Then an old hypodermic needle and syringe, such as a dentist might discard. If the needle and syringe cannot be obtained, go to an artists' supply house, or paint store, and buy a flexible palette knife of the offset-handle type, and which is not more than ¼ in. wide on the tip end. Lastly, a flat iron which is to be brought to full heat in boiling water, not over a flame.

To proceed: First locate the blister by tapping with the finger nail. A sharp clicking sound will indicate the margin areas. Use a pencil tip if you like that better. Mark the limits of the blister with a soft-lead pencil. Hold the razor blade at a 45-deg. angle to the face of the work, both in the horizontal and vertical planes, and proceed to slit the blister full length, *with the grain*. Use a slightly damp cloth beneath the hot iron to steam and make flexible the blistered veneer. While in this condition, use the needle or palette knife to force hot glue under the entire area. Lay on a piece of white bond paper, and use the flat iron to rub down the veneer until it again lies flat. Continue until all the blisters are repaired. Tap all over with the rubber on a pencil for spots missed. Dry several days and retest with the pencil. If all the veneer is tight, use varnish remover to strip off the old finish, scrub with alcohol, dry, and then sand with 6/0 paper and refinish. — *Ralph G. Waring.*

WATERPROOFING PICTURES

988. Q.: Could you please advise us concerning the finish that should be put on auditorium pictures where glass is not used? The pictures that we have framed in our practical-arts department are quite large and we are hanging them in our auditorium but do not wish to use glass unless it is absolutely necessary. The pictures are lithographs and are mounted on Upson Board. We have observed that similar pictures have been treated with a coating of white varnish or white shellac. Could you please tell us which one of these should be used, and where we might obtain it? — *D.D.M.*

A.: The problem presented in your letter has been met recently in a very similar instance in the treatment of a number of large pictures of George Washington in a four-color lithograph. These were ordered framed, by the art department, to be delivered without glass but the picture to be made waterproof for future cleaning without affecting the color or luster in any way. This order was met by spraying on a coat of shellac-mixing lacquer and white shellac. The standard white shellac was reduced with two parts of denatured alcohol and then added to an equal amount of Waterproof Mixing Lacquer as made by the Murphy Varnish Co., of Newark, N. J. This was then sprayed on in an even but thin coat with the result that it was all but impossible to determine which litho had been treated when placed alongside of one which had been sprayed. It could have been done with a wide fitch brush if the spray had not been available. — *Ralph G. Waring.*

Associations, Conventions

NATIONAL CONFERENCE ON INDUSTRIAL ARTS

A conference on industrial arts was called by the United States Office of Education at Washington, D. C., November 19, 20, and 21, 1934. The conference was held in the offices of the Office of Education, Maris M. Proffitt, Federal Office of Education, acting as conference leader.

The specialists attending the conference were asked to combine their experiences for the purpose of preparing a report setting forth the function of the industrial arts in the development of the child, and its place in the school program.

From left to right: Seated, H. A. Sotzin, Leon S. Winslow, M. M. Proffitt, Miss A. Adele Rudolph. Standing, Earl L. Bedell, Homer J. Smith, William E. Warner, Elmer W. Christy, Charles F. Bauder, and Roy G. Fales

The following were in attendance: Charles F. Bauder, Director, Division of Industrial Arts, Philadelphia, Pa.; Earl L. Bedell, Asst. Director Industrial Education, Detroit, Mich.; Elmer W. Christy, Director Industrial Arts, Cincinnati, Ohio; Roy G. Fales, State Supervisor Industrial Arts, Albany, N. Y.; G. A. McGarvey, Regional Agent, Vocational Education, Federal Office of Education, Washington, D. C.; Mrs. Lois C. Mossman, Teachers College, Columbia University, New York City; Miss A. Adele Rudolph, Special Assistant in Charge of Elementary Industrial Arts, Division of Industrial Arts, Philadelphia, Pa.; Homer J. Smith, Professor Industrial Education, University of Minnesota, Minneapolis, Minn.; H. A. Sotzin, Teachers College, San Jose, Calif.; William E. Warner, Professor Industrial Arts, Ohio State University, Columbus, Ohio; Leon S. Winslow, Director of Art, Baltimore, Md.; M. M. Proffitt, Educational Consultant and Specialist in Guidance and Industrial Education, Federal Office of Education, Washington, D. C.

CONNECTICUT INDUSTRIAL-ARTS ASSOCIATION MEETS AT HARTFORD

The Connecticut Industrial-Arts Association held its second convention luncheon meeting in the Bond Hotel, Hartford, on October 26. More than 150 persons were in attendance.

The guest speakers were Thomas F. Carberry, Hartford; Thomas J. Quirk and Karl A. Reiche, of Hartford. Other speakers were S. H. Holmes, New Britain; P. D. Collier, Hartford; Harry Wessels, New Britain.

Dr. David Sneeden, of Teachers College, Columbia University, speaking on the topic, "Future Prospects of Industrial Arts Subjects," said that all schoolwork should be divided into two real objectives — problem solving and appreciation. He emphasized that today all children are going to the secondary schools, and educators should know what kind of education they are capable of pursuing. Today presents a problem, and industrial arts must furnish a solution.

At the business meeting the reports of the secretary and treasurer were received. A motion was passed making the guests honorary members of the association. Members elected to the conference committee were Mr. Houdlette, Mr. McAndrews, Mr. Feuerstein, Mr. Cave, Mr. Case, Mr. Moran, and Mr. Barnicle. — *H. A. Barnicle.*

PEORIA INDUSTRIAL-EDUCATION CLUB MEETS

The monthly dinner meeting of the Industrial-Education Club of Peoria, Ill., was held on November 5. The meeting was attended by 40 members, who represented the schools of Peoria, Henry, Pekin, and Galesburg, and the Caterpillar Training School and Bradley Institute.

Mr. Carl F. Joyslin, of the Victor Foundry, East Peoria, talked on the subject, "The Relation of the Molder's Work to the Draftsman, the Patternmaker, and the Machinist." Mr. Joyslin gave a demonstration in molding a cup and saucer and showed patterns illustrating the work. — *F. F. Barloga.*

WISCONSIN INDUSTRIAL ARTS ASSOCIATION MEETS

The Wisconsin Industrial Arts Association had its annual meeting under the chairmanship of Roy R. Van Duzee, Supervisor of Industrial Arts, West Allis public schools, West Allis, Wis., on Thursday, November 1, in the Girls' Technical High School auditorium at Milwaukee.

Dr. Wm. E. Warner, Ph.D., Professor of Vocational Education, Ohio State University, Columbus, Ohio, was the main speaker. His topic was "Analysis of the Professional Antecedents Which Define and Should Control Any Industrial-Arts Program."

At the business meeting, the following officers for the year 1935 were elected: President, V. M. Russell, Teachers' College, Platteville; vice-president, R. A. Radtke, Milwaukee; H. J. Shufelt, Racine. Committee at large, Leo Ebben, Kohler; representative of state department, Frank V. Powell, Madison.

Following the business meeting, the group divided into six round-table sections, based on subject interest.

Thursday, at 6 p.m., the industrial-arts teachers had a joint

(Continued on page 6A)

NOW 1000 Schools Are Teaching Boys Woodworking

MORE than 1000 schools place their stamp of approval on Wallace Woodworking Machines. Why?

Safety—Boys work with comfort at Wallace Machines, with both feet firmly planted on the floor while operating.

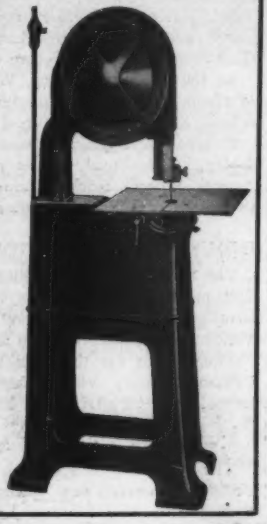
Practical—Wallace Machines are the kind boys will encounter in industry. More than 65,000 are in use in American Industry.

Low Cost—Wallace Machines cost less than one third as much as large planing mill type machines in investment and operation, yet they are better adapted to school shop work.

There is a Wallace Factory representative near you. You are invited to talk over your woodworking shop problems with him. Ask for Catalog No. 407.

J. D. WALLACE & CO.
140 S. California Ave., Chicago

with Low Priced, High Speed, Direct Drive
WALLACE MACHINES



A beautiful moderate priced

CARRARA VELLUM

for the new W. S. Sparkling

ANNOUNCEMENT LINE

of matched envelopes, cards and sheets for formal and business use.

Elegant effects are obtained for Commencement Invitations using this stock as a background.

SAMPLES FOR PROOFING GLADLY FURNISHED.

The Western States Envelope Co.
West Pierce St. at 16th Street Viaduct
MILWAUKEE WISCONSIN

Keep a crate of beautiful ALGOMA Plywoods in your school storeroom. . . . Re-order only five or six days before you need more.

•

We'll ship f-a-s-t and on-time from the ALGOMA warehouse nearest you . . . on the day that we receive your order.

•

Ask for the ALGOMA catalog. Order from it. Try a trial crate of your own choice: Basswood, Oak, Mahogany, Walnut, Birch . . . anything you want. You'll be delighted with our Walnut-Cedar Sets, too, which make a complete and beautiful cedar chest.

•

Prices??? ALGOMA panel prices are famously low. Despite their advantages, ALGOMA plywood prices are never more than solid lumber prices; frequently they're less.

•

ALGOMA plywoods offer many advantages that solid woods simply cannot give you. It is so easy to work that it is a "cinch" for your younger students and the older ones simply make it talk. They find it easy to saw and trim and fit . . . and nail. When they do nail it, it doesn't split on the edges. It doesn't warp nor blister nor split nor swell. It is strong for it is cross-banded. It is sanded smooth, ready for any stain or paint finish.

Ask our nearest office for the catalog and then a trial crate. You'll like it. We'll send it *fast*, that day.

ALGOMA PLYWOOD & VENEER CO.
Plywood Mills and General Offices, Algoma, Wisconsin
Veneer Mills—Birchwood, Wisconsin
Cincinnati, 634 Eden Park Entrance, Cherry 7823 • Chicago, 1234 N. Halsted St., Diversey 4342 • Cleveland, 5400 Brook Park Rd., Shadyside 1400 • Detroit, 15530 Idaho Ave., Longfellow 6338

Algoma
THE BETTER PLYWOOD

KEYSTONE "pure hide"

IS DAILY BECOMING BETTER KNOWN AS THE STANDARD OF GLUE EXCELLENCE IN VOCATIONAL WORK

SINCE vocational instructors were introduced to Keystone ***Pure Hide*** Glue through our FREE TEST SAMPLE OFFER a few short months ago, we have listened to countless expressions of satisfaction over the fine job that this superior adhesive is doing in the leading school shops of America.

Instructors are seeing for themselves that in Keystone ***Pure Hide*** the strength is there to stay. And besides, its fine workability makes it the ideal glue for the student as well as the professional cabinetmaker to use.

Generous FREE TEST SAMPLES are still available to bonafide Vocational Instructors and Supervisors.

Write

KEYSTONE GLUE COMPANY

DEPT. B-9

Manufacturers of *Pure Hide* Glue Exclusively

WILLIAMSPORT, PENNA.

Have you written for your free copy of the GLUE HANDBOOK? Do it now.

(Continued from page 32)

dinner meeting with the Industrial and Educational Counselors Association, Industrial Relations Association, Wisconsin Association of Secondary School Principals, and Wisconsin Vocational Guidance Association.

On this occasion, Dr. Warner spoke on the "Practical Arts as a Means of Integration and Enrichment."

Friday, at 2 p.m., the industrial-arts teachers visited the Allis Chalmers Manufacturing Company plant.

WISCONSIN VOCATIONAL ASSOCIATION MEETS

The Wisconsin Vocational Association held its annual meeting at a twelve-o'clock luncheon on Thursday, November 1, at the Plankinton Hotel, Milwaukee, with West A. Burdick, Madison, as chairman.

Mr. L. H. Dennis, Executive Secretary of the American Vocational Association, Washington, D. C., was the principal speaker. His subject was "The Future of Vocational Education."

At the business meeting, West A. Burdick, Vocational School, Madison, was elected president, and Jacob Spies, Vocational School, Sheboygan, secretary-treasurer.

Following the business meeting, round tables on trade and industry, agricultural, commercial, home-making, rehabilitation, general subjects, teacher training, and co-ordination were held at the Vocational School, Milwaukee.

INDUSTRIAL-EDUCATION CLUB MEETS AT FRESNO

The Fresno Industrial-Education Club of Fresno, Calif., held its first meeting of the season in the board room of the Administration Building, on Friday, October 19. At this meeting the Valley group was invited to attend with the Fresno group.

The officers for the year 1935 are president, Deane Simpson, Edison School; vice-president, Wiley Hudson, Continuation School; secretary-treasurer, H. J. Bingham, Edison School.

NEW OFFICERS OF MINNESOTA ASSOCIATION

The Industrial-Arts Section of the Minnesota Education Association has elected new officers for the year 1935, as follows:

President, Mr. Stanley J. Pawelek, State Teachers' College, Winona; vice-president, Mr. C. C. Clapper, Litchfield; secretary, Mr. F. Fabro, Alexandria.

Personal News

MR. ALLEN RETIRES

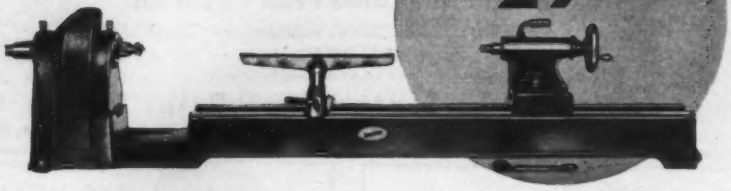
Mr. Charles R. Allen, educational consultant in vocational education for the U. S. Office of Education, has announced his retirement from the government service. Mr. Allen, a pioneer in the field of vocational education, was the originator of methods for selecting and training teachers of vocational education. He devised

Mr. Charles R. Allen

the methods of job analysis designed to aid teachers in formulating practical courses in trade and industrial education and was responsible for the development of the conference method of training industrial foremen in the job of teaching workers under their supervision.

(Continued on page 7A)

New DRIVER LATHE
For Turning Wood or Metal
$29.95



The Driver "700" Lathe fits in with the most stringent of school budgets. Here is a lathe that embodies every worthwhile feature for school shop use—safety—rigidity—accuracy and the ability to stand hard use.

The bed is made of heavy casting carefully machined. With the three point bed you can bolt the lathe to an uneven surface without distorting or pulling of the ways out of line. The head stock guard provides a maximum of safety at a point where it is most needed.

This is exceptional tool value, costing only a little over 2 cents per pound (shipping weight of lathe is 130 lbs.).

Recommend Driver Power Tools and your judgment will be respected.

Send 10c (to cover cost of mailing) for free 1935 Driver catalog and for 100 page illustrated handbook containing complete projects for school use.

WALKER-TURNER CO. INC.

815 Berckman St. **Plainfield, N. J.**

INSTRUCTORS

The Walker-Turner Company has prepared four instruction books, The Bench Saw, Jointer and Shaper—The Drill Press—The Lathe and The Band Saw and Jig Saw.

Each book contains 72 pages of real professional information and short cuts written in simple non-technical language. They will be of great aid to your students for a better understanding on the uses and applications of these tools.

Books are 50c each, $1.50 for set of four. Use coupon below to order.

WALKER-TURNER CO. INC.
815 Berckman St.
Plainfield, N. J.
Please send me the following books—

Name .....
Address .....
City.....State .....

(Continued from page 6A)

Mr. Allen received his early education in Friends Academy and the high school in New Bedford, and was graduated from the Massachusetts Institute of Technology, where he specialized in chemistry, in 1885. Later he took postgraduate work at Johns Hopkins University and Harvard University, from which he received the master of arts degree in 1903.

From 1911 to 1917 he served as agent for industrial education for Massachusetts. He was director of industrial training at Dunwoody Institute, Minneapolis, from 1922 to 1924, and has been a member of the staff of the Federal Board for Vocational Education since 1918. He holds the degree of doctor of science, conferred upon him by Stout Institute, Menomonie, Wis.

Buy Christmas Seals

Help Fight Tuberculosis

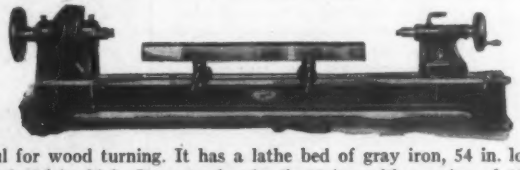
Mr. Earl Marihart, formerly of Princeton, W. Va., has been appointed to a position in the industrial-arts department at Dubuque, Iowa. In his new position he will divide his time between the Jefferson Junior High School and the Central Continuation School.

SchoolShopEquipmentNews

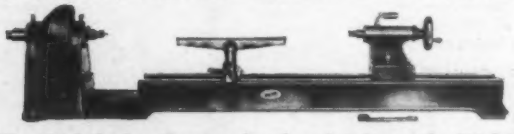
NEW WALKER-TURNER LATHES

The Walker-Turner Co., Inc., manufacturers of tools and hardware specialties, Plainfield, N. J., has announced two new lathes for wood turning and metal turning.

The 700 gap-bed lathe is an all-purpose lathe for wood or metal turning. It has a compound slide rest, and its gap-bed feature has been developed primarily for metal turning. With the extra capacity near the headstock, it will be found very use-



ful for wood turning. It has a lathe bed of gray iron, 54 in. long and 4⅛ in. high. Its normal swing is 10 in., with a swing of 13½ in. at the gap. The double row of preloaded SKF ball bearings will carry any load imposed. Four speeds, 700, 1300, 2300, and 4200 r.p.m., are provided, and the tailstock has set-over for tapers.



The 900 lathe has the same length and swing as the 700 lathe, but its massive construction gives it extra rigidity. The bed is of gray iron, ground and polished. The headstock pulley has a

(Continued on page 9A)

The School Shop Shopping Guide

LEATHERCRAFT

WILDER LEATHER CHICAGO

for the Classroom or Shop is simplified by the use of

WILDERCRAFT INSTRUCTION SHEETS

Give the students full directions for decorating and constructing leather articles. A copy free on request. Also a price list of craft leathers, laces, modeling and stamping tools, splitting and veining tools, snaps and snap-setting tools, "Quickwork" Lacing Punches and lacing needles, dyes, etc.

Send 5c for Leather Sample Cards

WILDER & COMPANY

1038 Crosby St. Chicago, Ill.

Instruction Sheets in Woodworking

UNIT OPERATION SERIES I—Ten sheets on ten common operations.

INTER. PROJECT SERIES VIII—Six projects on ten sheets. PRICES—1 set $.35, 4 sets $1.00, 50 sets $9.00, 100 sets $15.00, 500 sets $50.00. Money orders preferred. Under N.R.A.

CLIFFORD B. SMITH, 516 Dartmouth St., Buffalo, N.Y.

Nothing so rich in romance as—

FURNITURE WEAVING

—nor so well suited for TODAY'S classes

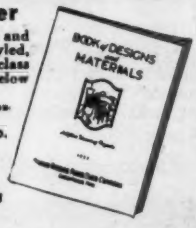
Here Are 5 Reasons for its rapidly increasing popularity

1. Projects for all tastes and purses.
2. Simplified, expert workmanship.
3. All practical, saleable projects.
4. No special equipment needed.
5. No special power required.

And it is so simple and easily taught . . . *the modern Grand Rapids Way.* Small wonder so many schools are adding it to their courses, and finding it one of the most appealing - and most instructive-classes they have.

Get This Folder

Illustrates scores of large and small projects—each styled, designed and planned for class work. Fill in spaces below and mail—no obligation.



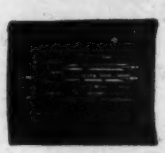
Grand Rapids Fibre Cord Co.
Dept. A ,609 Myrtle St.
Grand Rapids, Mich.

Rush a copy of your Catalog

Name .....

School .....

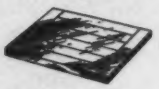
Address .....



United States Blue Print Paper Co.

A complete line of Drafting Materials for Schools and Colleges

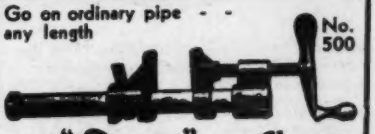
Let us quote on your requirements



United States Blue Print Paper Co.

207 South Wabash Ave. Chicago, Illinois

Go on ordinary pipe - - any length



TRADE "Pony" MARK **Clamp Fittings**

Make rigid, light, economical clamp of any length. Multi Disc Clutch grips bar automatically at any point—permits instant fitting—foot never loose on bar—is released easily by finger grips. Discs may be easily reversed or replaced at low cost. ¾" steel Pipe serves as bar.

ADJUSTABLE CLAMP CO.

Write for Catalog *The Clamp Folk* 424 N. Ashland Ave., Chicago, U.S.A.

ART METAL and JEWELRY WORK

Equipment and Supplies

Tools of all kinds for Jewelry, Silver, and Copper, Rose Hammers and Anvils. When ordering be sure to

SPECIFY "ROSE"

Gold, Silver, Copper, Brass, Pewter, and Nickel Silver in sheet and wire form. Semi-Precious stones. Send for our catalog B. Ask for a sample copy of our Brochure, "Things In and About Metal," sent free.

METAL CRAFTS SUPPLY CO.

Providence, R. I.

BASKETRY SUPPLIES

PRIME REED, large assortment Colored Raffia, Chair Caning, and Weaving Supplies. Everything for the Handcraft Worker.

Catalogue on request

AMERICAN REEDCRAFT CORPORATION
130 Beekman Street New York City

PEWTER

AND BRITANNIA METAL

Sheets: 24"x36" or smaller
Circles: 2" to 24" diameter
Specify size and gauge.

NATIONAL LEAD CO., Dept. P
New York Chicago St. Louis

KNIVES THAT ARE BETTER TO USE

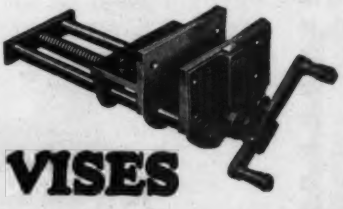
Instructors and students everywhere prefer Murphy Knives for school shop use. They are made of the finest steel. Blades are securely set in the handles. They do not come loose. Handles are shaped to fit the hand perfectly. The edges of blades are hand honed to STAY SHARP. All in all, Murphy Knives for sloyd, stencil or manual training work are easier and better to use.

Ask for a catalog of the complete line

Robert Murphy's Sons Co.

AYER, Est. 1850 MASS.

COLUMBIAN VISES



The complete "Columbian" line includes vises of every style and size for wood and metal work. Also drop forged steel "C" Clamps.

THE COLUMBIAN VISE & MFG. CO.
"World's Largest Makers of Vises"
9017 Bessemer Ave. Cleveland, Ohio

CASTINGS

and Blue Prints to Build a large variety of fine HOME WORKSHOP MACHINES in the school shop. Castings made to order. Send for free catalog.

DESIGNERS COMPANY

724 Monroe Ave. RACINE, WIS.

FREE SAMPLES

for teachers of auto mechanics and their students

Teachers: How many students have you?

write

PEP MFG. CO.

INCORPORATED

33 W. 42nd St.
New York

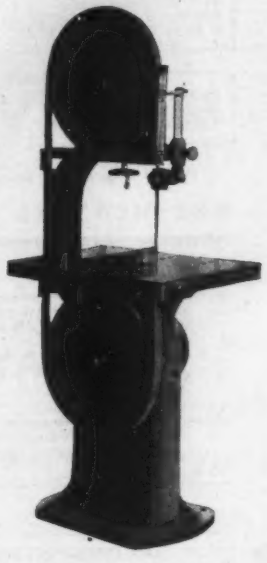
ADVERTISING PAGES REMOVED

(Continued from page 7A)

positive locking device to hold turnings stationary for fluting or reeding. The weight of the bed is several times that of the average lathe bed of similar capacity. Three-point lugs are used for attaching the lathe to the bench, to avoid all bed distortion. The headstock spindle has a right-hand thread on one end, and a left-hand thread for large plate work on the other. The face-plate fits closely to the bearing to permit the handling of heavy work without springing the spindle.

NEW PORTER-CABLE BAND-SAW TABLE

The Porter-Cable Machine Co., Syracuse, N. Y., has announced a new square band-saw table which can be furnished as optional equipment for the 20-in. Porter-Cable band saw. This substantial



cast-iron square table is furnished with a ripping fence and miter gauge. Another one of its advantages over the former round table is the increased area for supporting long work.

The new table is substantially built of cast iron, properly ribbed. It is machined at the tops and sides. The upper surface is ground. The table can be tilted from 30 deg. up, to 5 deg. down.

Complete information is available upon request.

NEW HANGER FOR MONOTYPE GIANT CASTER FACES

The Lanston Monotype Machine Company, Philadelphia, Pa., has issued a hanging chart, showing monotype giant caster faces.

The hanging chart provides a wide selection of display types at a glance. It represents probably the largest number and the greatest variety of type faces ever printed together on one page, and will be found of considerable value for reference purposes. The hanger has not only educational value but will be found very useful in designing special printing jobs.

The firm announces that 100 additional giant faces are available over and above those shown on the chart.

A copy of this hanger is available to school printshop instructors.

E. C. ATKINS AND COMPANY ANNOUNCES CONTEST

In recognition of the 300th anniversary of the Boston Latin School, the forerunner of our modern public high school, E. C. Atkins and Company, Indianapolis, Ind., is offering a series of prizes for the best scale replicas of the first schoolhouse in each community. The best replica in each community is to be chosen by a jury composed of a local instructor of woodworking, a teacher of history, and a hardware dealer. The national prizes will be distributed through the committee for the scholastic awards, of the national high-school weekly, *Scholastic*.

For further information write E. C. Atkins and Company, Indianapolis, Ind., or the Celebration Committee, National Education Association, Room 1306, 155 East 44th St., New York City.

MAINTENANCE ECONOMY AND OUTSTANDING MANUAL TRAINING START HERE

More than 2000 Schools Are Using TAKE-ABOUT Sanders

Here is the proven solution to a mighty tough problem. It is the answer to a restricted budget. The TAKE-ABOUT Sander shows greater economy in maintenance work than you would believe possible. With its abrasive speed of 1500 feet per minute the TAKE-ABOUT quickly refinishes school desks, seats, chairs, tables, blackboards, doors, sash, woodwork and even stone tops on laboratory tables. Proof enough that the TAKE-ABOUT is the quickest self-liquidating investment any school ever made.

Free Equipment for Manual Training Departments

Saves hand planing, sanding and scraping allowing additional time for instruction. Inspires students to do a better job all the way through. Raises the standard of work. Gives the instructor results of which he can be proud. The TAKE-ABOUT is built sturdily for constant use instruction and on maintenance work.

Write now for details. No obligations whatever. We'll be glad to send the facts and a new free instructive abrasive chart. Do this now while you have it in mind.

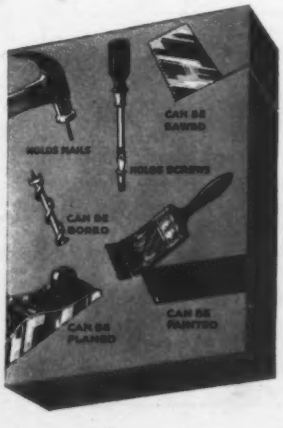
PORTER - CABLE SANDERS MOST WIDELY USED IN THE WORLD

We also Manufacture 35 different Band Saws, Jointers, Shapers, Disc, Spindle and Belt Sanders

The PORTER-CABLE MACHINE COMPANY

PRECISION MACHINERY BUILDERS SINCE 1906

1709-1 No. Salina St. SYRACUSE, NEW YORK



IT'S REAL WOOD IN CANS

HANDLES LIKE PUTTY
Dries to Permanent Wood
Has 1001 Uses

Plastic Wood is wood in putty form—so smooth—so pliable will adhere to any clean, dry surface—wood, metal, glass. Can be worked with any wood-working tools, will hold nails, screws, without splitting or crumbling. Can be planed, sawed, carved, turned on lathe. Has all the properties of actual wood with the exception of grain.

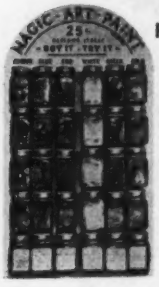
Genuine Plastic Wood can be secured in a can or tube at any Hardware, Paint or Department Store.

FREE

Write The A. S. Boyle Co., Inc., 1934 Dana Avenue, Dept. IA.-1 Cincinnati, Ohio for the interesting booklet on the many uses of this marvelous discovery Plastic Wood.

The School Shop Shopping Guide

MAGIC ART PAINT



MOST SENSATIONAL PAINT FINISH CREATED

MAGIC ART PAINT is a decorative finish easily applied to any glazed surface, on which it forms the most artistic and marvelous designs by itself. Is transparent and available in eight colors. Purchase from your local Paint or Hardware store or direct from us.

Ask for complete information.

MAGIC ART PAINT COMPANY

Dealers Display Board Hasbrouck Heights N. J.

HOLD-HEET Automatic GLUE POTS Electric

Shockproof, mica insulation. The standard pot of woodworking industry. Nothing to regulate or forget. Eliminate fire hazards. Maintains temperature accurately to 1°, assure lasting joints.

30-day Free Trial

State size and voltage wanted. Return in 30 days if it doesn't prove the best pot regardless of price.

Russell Electric Co.
366 W. Huron Street
Chicago, U.S.A.

1 qt.	$14
2 qt.	$17
4 qt.	$24
8 qt.	$36

115 or 230 Volts

SOLD BY JOBBERS

VENEER SPECIALS

OFFER No. 1

100 ft. of matched veneers. 35 ft. Sliced Walnut; 29 ft. Walnut Butt; 17 ft. Oriental Wood; 21 ft. Mahogany; 4 ft. Snake Wood. All for $5.00. A $13.60 value.

OFFER No. 2

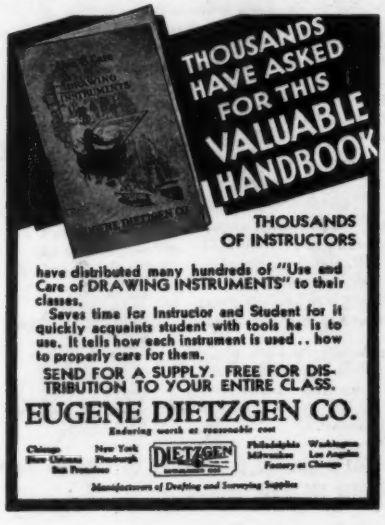
46 ft. of matched veneers. 15 ft. Sliced Walnut; 12 ft. Butt Walnut; 8 ft. Oriental Wood; 9 ft. Mahogany; 2 ft. Snake Wood. All for $2.50. A $5.81 value.

OFFER No. 3

22 ft. of matched veneers. 8 ft. of Sliced Walnut; 5 ft. Walnut Butt, 4 ft. Oriental Wood; 4 ft. Mahogany; 1 ft. Snake Wood. All for $1.00. A $2.36 value.

Schools allowed 15% discount
F. O. B. San Francisco, California

ART INLAYERS 2695-21st Avenue San Francisco, Calif.


THOUSANDS HAVE ASKED FOR THIS VALUABLE HANDBOOK
THOUSANDS OF INSTRUCTORS
have distributed many hundreds of "Use and Care of DRAWING INSTRUMENTS" to their classes.
Saves time for Instructor and Student for it quickly acquaints student with tools he is to use. It tells how each instrument is used .. how to properly care for them.
SEND FOR A SUPPLY. FREE FOR DISTRIBUTION TO YOUR ENTIRE CLASS.
EUGENE DIETZGEN CO.
Enduring worth at reasonable cost
Chicago New York Philadelphia Washington
San Francisco Pittsburgh Milwaukee Los Angeles
DIETZGEN
Factory at Chicago
Manufacturers of Drafting and Surveying Supplies

PEWTERCRAFT

The New Industrial Art Subject

Send 10c for reprint on Pewtercraft

The Pewtercrafter
29 Meadow Bronxville, N. Y.

MOIST OR DRY MODELLING AND POTTERY

CLAY

in all quantities

We also carry Red-burning Clay, Grog, Pottery Glazes, Modelling Tools and all Ceramic Supplies.
Write for Free Sample or Catalogue

CERAMIC ATELIER
733 So. Kilbourn Ave. Chicago, Ill.

Everything for Basketry Work

Reeds, Chair Cane, Rattan, Willows, Raffia, Straw Braid, Hong Kong Grass, Fiber Rush, Shellac, Dyes, Paints, Brushes.

J. W. WARNECKE CORP.
Grand and Second Sts., Hoboken, N. J.

"USED MOTORS, TOOLS, GENERATORS, SHAFTING, BELTING, MACHINERY, Etc.

For sale @ 2c per lb. cold rolled sheet steel 10 gauge to 22 gauge widths 1" to 4" to 8" 5 to 8 ft. long. What do you need in the USED line?"

H. M. ALPERIN
527 Concord Ave. Cambridge, Mass.

LEATHERCRAFT

Genuine goat lacing 3c per yd.

FREE CATALOGUE AND SAMPLES OF OUR OKO BRAND LACING

everything for the leathercraft worker

LEATHERCRAFT SUPPLY CO.
218 So. Juliette St. Manhattan, Kansas

UPHOLSTERY FABRICS
CABINET HARDWARE

Catalog upon request

The UPHOLSTERY SUPPLY CO.
1033 No. 4th St. Milwaukee, Wis.

ARCHERY STAVES

Extra fine tough hickory lumber 1¼" thick, six feet long cut especially for bow staves. Each 100' guaranteed to produce at least 125 good staves. PRICE ONLY $35.00 per 100'—less than 30' at 40c per bd. foot. Folder free.

INDIANHEAD ARCHERY
Box 303 LIMA, OHIO

AERONAUTICS INSTRUCTOR

educated and thoroughly trained in the field of aeronautics, desires position in vocational school. Well known and highly successful in aviation industry. Practical and original in his work. Supt. of U. S. Dept. of Commerce Approved Repair Station.

Address Dept. M-13, Industrial Arts and Vocational Education, Milwaukee, Wis.

ART LEATHERS

FOR CRAFT WORKERS

A 5-cent stamp brings you samples. (Samples free to teachers, camp instructors, etc. Send your request on official letterhead or give your connections.) Sold by the whole or half skin also cut to measure. Tools, designs, lacings, both in calf and goat skin, snap fasteners to match leathers, leather dye, wax polish. Sphinx Paste, slide fasteners and bag plates.

W. A. HALL & SON
Dept. B 250 Devonshire St., Boston, Mass.

Now ready--the first in the series of

PRINTING JOB SHEETS

BY C. W. HAGUE

• • •

A systematic and logical presentation of the fundamental principles of Elementary Composition, based on sound teaching methods--the result of the author's long experience as a printing instructor.

Loose Leaf, 22 sheets. Price, 50 cents.

The Bruce Publishing Co., Milwaukee, Wis.